



Release 5.1 - User Manual

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Label

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About this Manual

This user manual describes the setup and operation of the WiMAP-4G software. The WiMAP-4G user manual requires a basic understanding of the Windows operating system. If you are not familiar with this system, refer to the documentation provided by Microsoft.

Newcomer of WiMAP-4G software should read

- Chapter 1 to learn about the program, requirements and installation
- Chapters 2 and 3 to learn about WiMAP-4G essentials

Conventions

Convention	Notice Type	Use
<i>Italic</i>		User actions
Bold		Marks user interface elements such as buttons, menus, label, tabs
	Caution	Describes important features, instructions or limitations
	Tipp	Highlights features or hints that can save time and prevent difficulties
	Step by Step	Step by step explanation
	Info	Additional information

Technical Assistance

For technical questions or problem solving assistance, *read the section which is related to your performing operation.*

If additional assistance is needed, *contact the brown-iposs support.*

Have following information ready for the brown-iposs support to detect a problem:

- any error messages
- details of recent system performance
- WiMAP-4G version number (can be found under Help→Info)
- operating system on your computer

1 Introduction

1.1 WiMAP-4G

WiMAP-4G is the radio network planning software by brown-iposs. It is developed particularly for planning the air interface of wireless broadband access networks, e.g. based on WiMAX and WLAN standard. Also other carriers are supported. The software is Java-based and able to run on every modern standard computer. WiMAP-4G is suitable for both, beginners as well as experienced users and offers sufficient possibilities to plan even the largest projects.

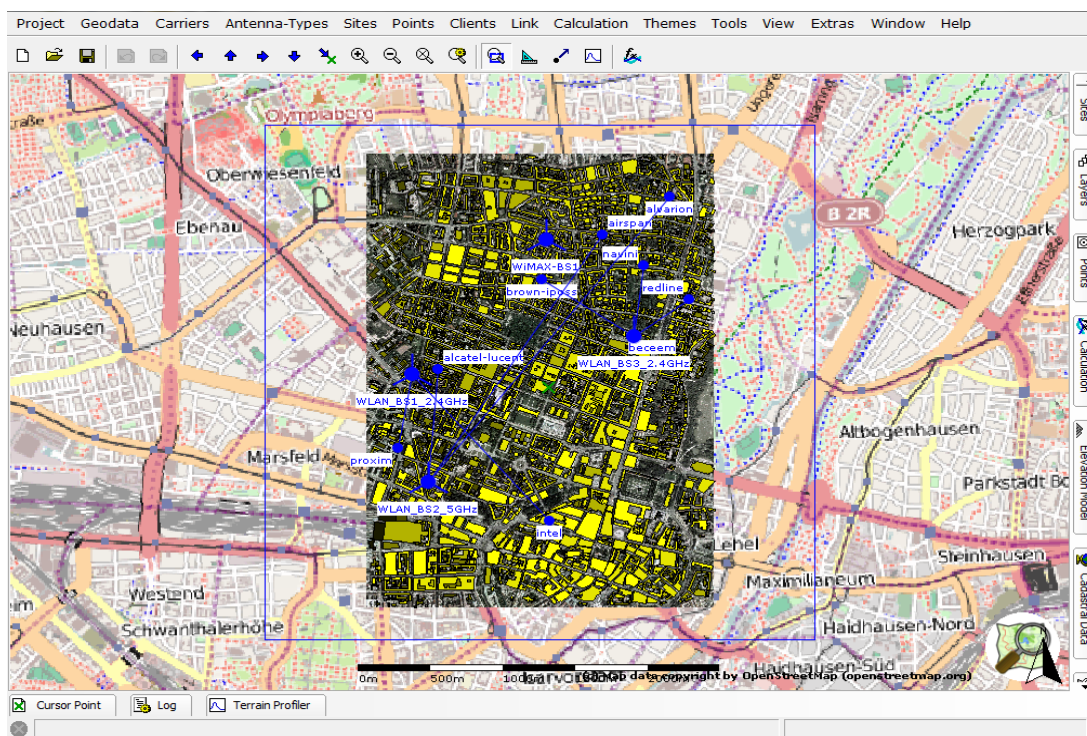


Figure 1: The WiMAP-4G working interface

1.2 WiMAP-4G Editions

Currently there are two different versions of WiMAP-4G available. The Professional-Edition offers additional features and supports more objects in the same project.

1.2.1 WiMAP-4G Community-Edition

The WiMAP-4G Community-Edition is a free version, which contains most of the functionality, but with specific restrictions.

Features of the Community-Edition:

- a configurable and clean interface
- easy generation of new projects
- import of cadastral data
- import of elevation models
- lists buildings and wood
- provides a large number of different antennas
- constructing clients and points
- extensive calculation options
- many different themes
- a 3-dimensional view of the terrain
- the Terrain-Profiler to keep track of the area
- detailed calculations with the link budget
- isolines
- export of isolines
- propagation models
 - Erceg model (provides three different patterns or individual creation)
 - ITU-R P.1411-3
 - Free Space Propagation



The Community-Edition allows a maximum of 12 radio stations and 50 points of the same type within one project. Moreover, it is not possible to use the highest accuracy level for calculations. Some import and export functions are working in the Professional-Edition only. This version is a sample of the software which gives the user an opportunity to try it out without having to purchase a complete version. It is completely suitable for smaller projects.

1.2.2 WiMAP-4G Professional-Edition

The WiMAP-4G Professional-Edition is the chargeable version of the program. It contains all functions of the WiMAP-4G Community-Edition including the following additional features:

- generates buildings and wood from cadastral data
- imports Corine data
- provides calculations with the highest accuracy
- CORLA-Raylauncher (Cube Oriented Ray Launching Algorithm) as an additional propagation model
- WinProp as an additional propagation
- large selection of antenna patterns
- extended export formats

The WiMAP-4G Professional-Edition offers high flexibility and delivers additional tools for planning carrier networks.



Figure 2: The Professional-Edition offers CORLA as an additional propagation model.

1.3 System Requirements

WiMAP-4G is a Java based software and therefore compatible with every windows operating system. 64-bit systems are supported, too.

Minimum system requirements:

- Operating System: Windows XP/7/8 or similar (has to be windows)
- Computer Processor: Pentium III with at least 1 GHz or equivalent
- Computer Memory: 2048 MB or more
- Internet: connection is required to get a license file and to use OpenStreetMap



Since WiMAP-4G is Java-based, other platforms may be supported on request. To run the 64-bit version of WiMAP-4G a 64-bit-Java-Runtime-Environment is required.

1.4 Installation

On <http://www.brown-iposs.com/en/wimap4g/download.php> you will find all required installation files, a list of features and the WiMAP-4G software license agreement.

The windows installer file WiMAP-4G Professional-/Community-Edition is required for installation. It is a zip file which needs to be unzipped before the installation.



1.4.1 How to Install WiMAP-4G

1. Unzip the downloaded **Wimap-4G-v5_1_0-setupNN.zip**. (NN=32 or 64 according to your choice)
2. Start installation by double-clicking the extracted **setup.exe**.

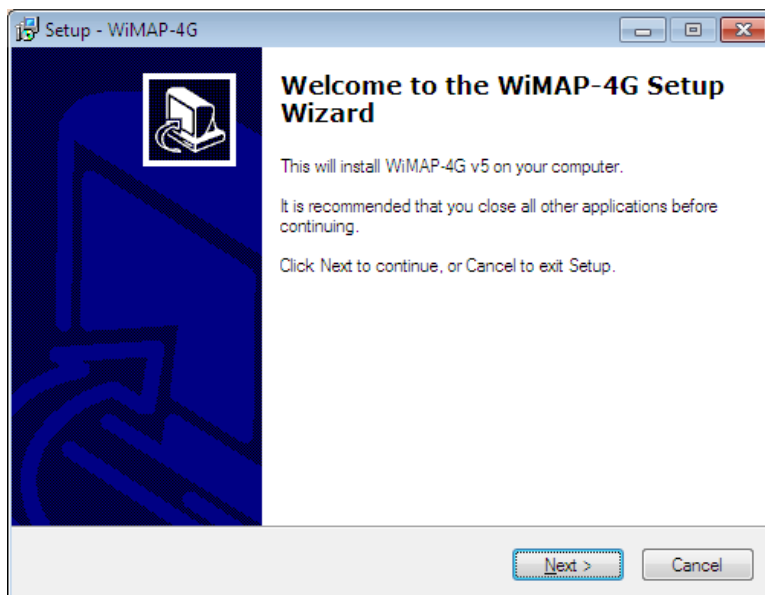


Figure 3: Installation has been started

3. Choose **installation directory**.

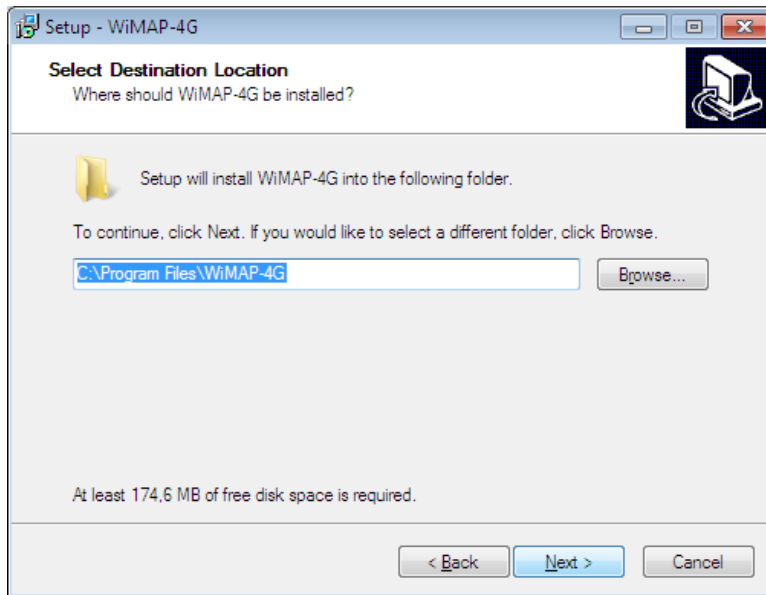


Figure 4: Installation directory

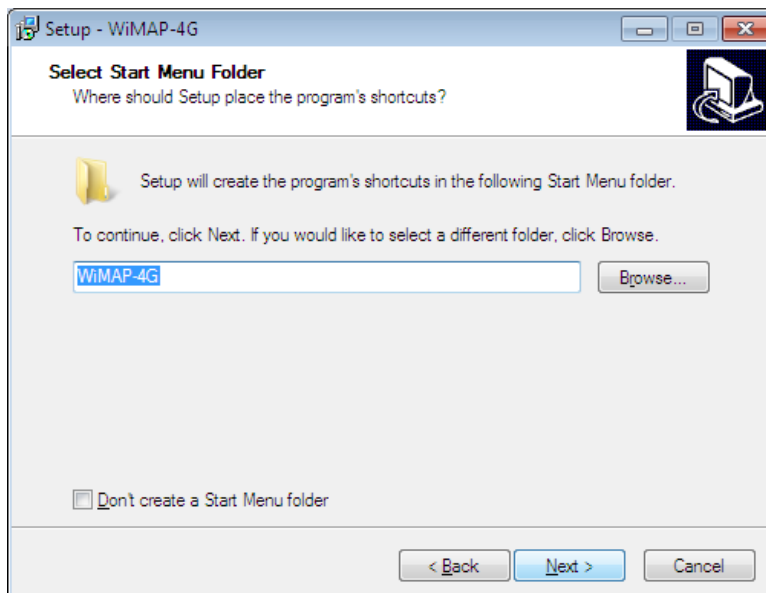


Figure 5: Start menu folder selection

4. *Select program icon locations.*

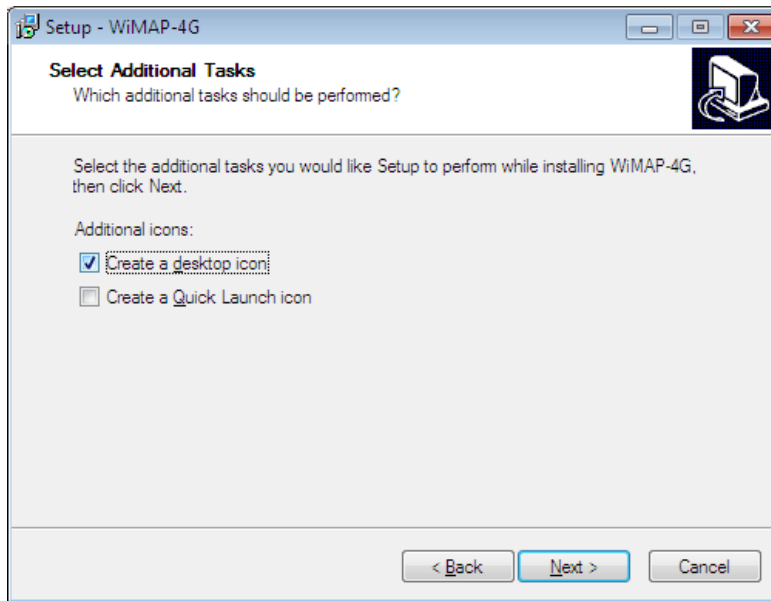


Figure 6: Program icon location

5. Click **Next** to start installation.

1.5 Launching WiMAP-4G for the First Time

After the installation is completed successfully, the program can be started for the first time.

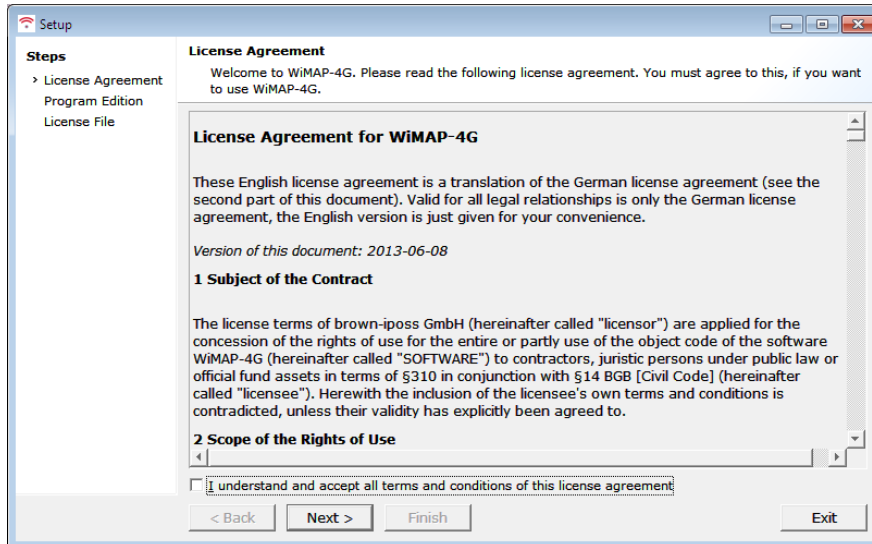


Figure 7: License agreement

WiMAP-4G needs a license to run. There are licenses for Community Edition and Professional Edition. For using the Community-Edition, a name and a valid e-mail address are sufficient. A license file is sent by e-mail and is available immediately.

1.5.1 Get a License for the Professional-Edition



A license for the Professional-Edition can be purchased later. To run the Professional-Edition an USB-Dongle is needed, which is provided by brown-iposs.

1.5.2 Get a License for the Community-Edition

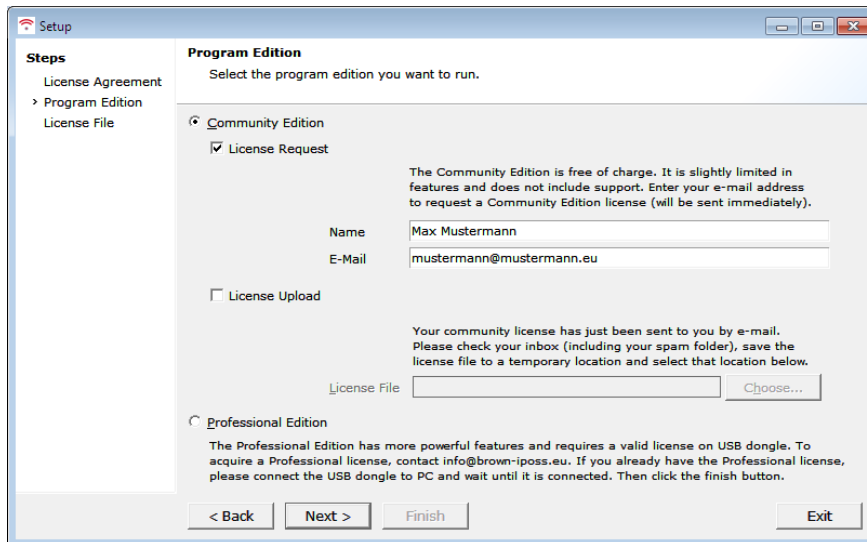


Figure 8: Program edition / License request

After completing the required fields with valid information, an e-mail will be sent to the named e-mail address. This license file is required so it is ought to be downloaded first.

After downloading the file it can be selected by *clicking **Choose** and entering the correct file path*. If this is a valid license file, WiMAP-4G will start for the first time.

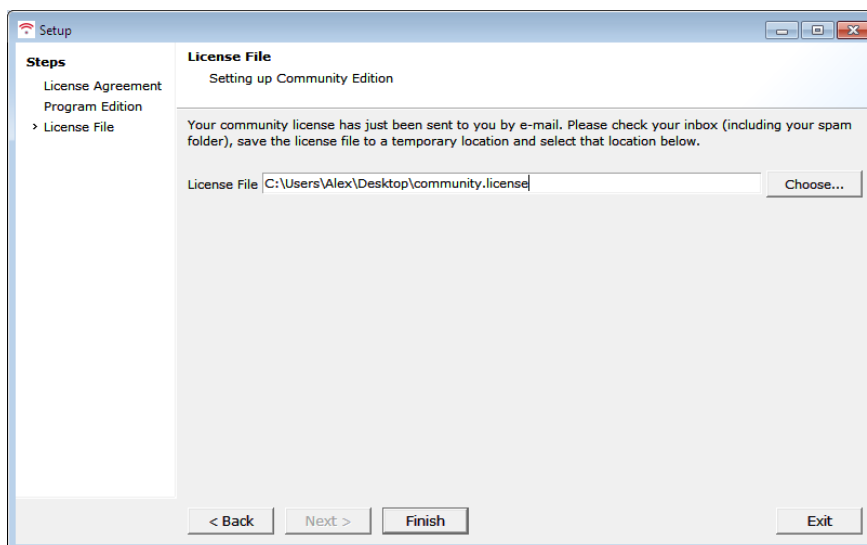


Figure 9: Choose location of your License file

If there are any problems, *try to find a solution in the FAQ* at the end of the user manual first.

2 First Steps

2.1 The First Project

After installation and activation are successfully completed the program launches and a new project can be created.

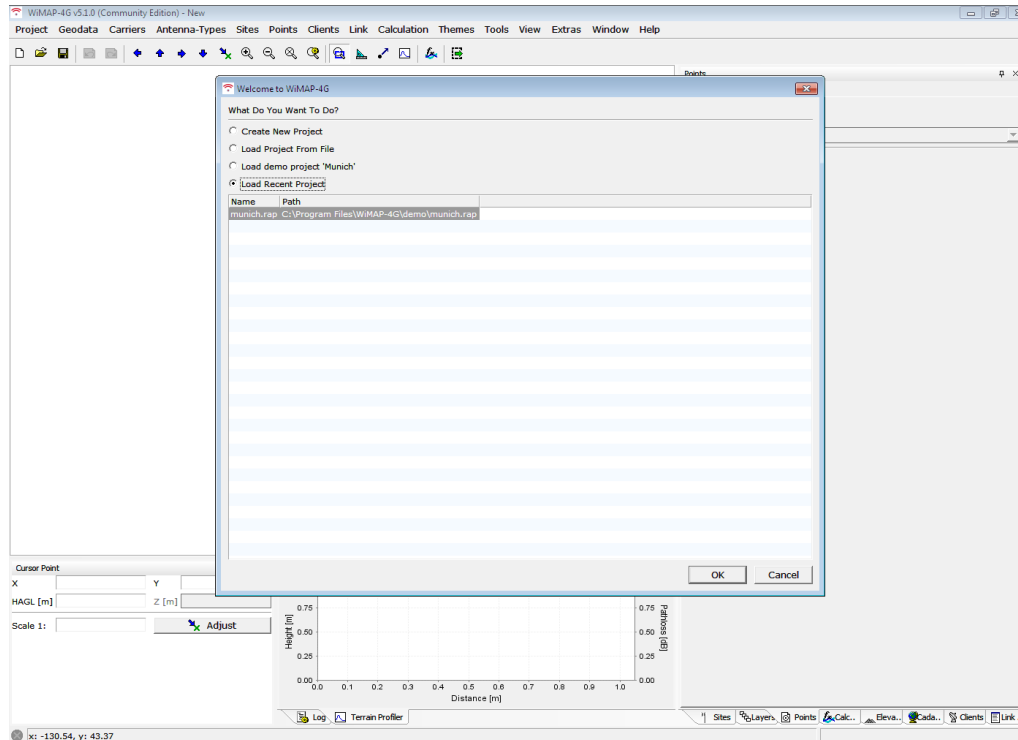


Figure 10: WiMAP-4G launches for the first time

After launching WiMAP-4G for the first time there are three possibilities:

- Create a new project.
- Load a project from a .rad file.
- Have a look at the demo project "Munich".

Newcomers should take a look at the demo project to get an impression of the program and its possibilities.

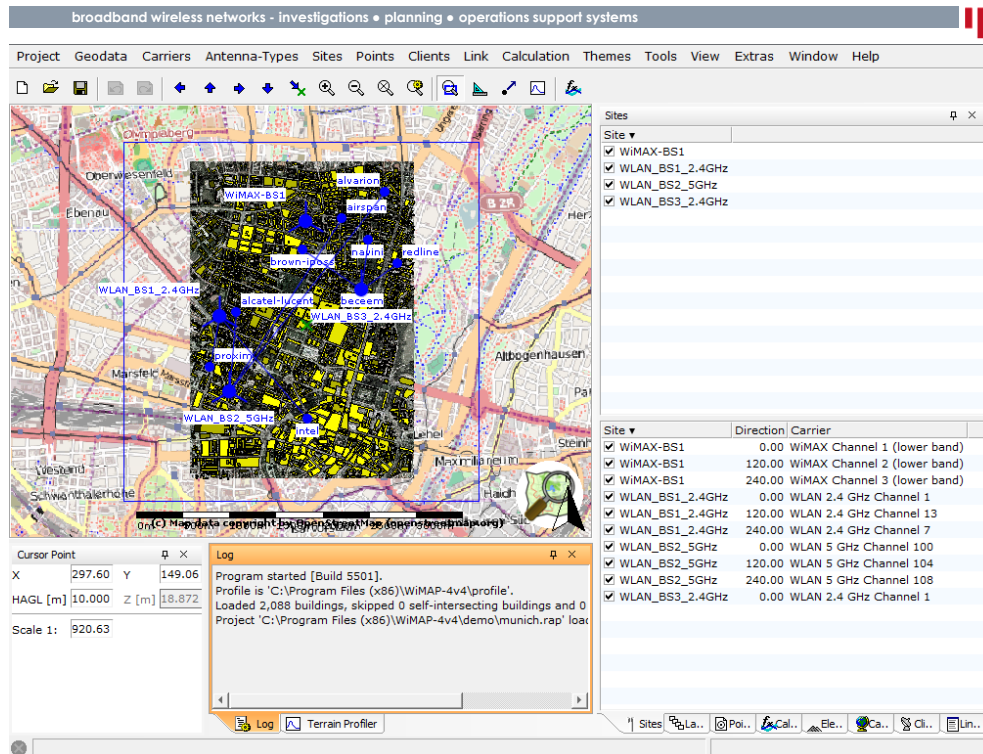


Figure 11: Demo project "Munich"

The demo project is a complete project including sites, different carriers and an elevation model. The Terrain Profiler can be tested as well as different propagation models.

2.2 Work Area

WiMAP-4G is clearly arranged to make work easier for experienced users and even for newcomers.

2.2.1 Work Area Basics

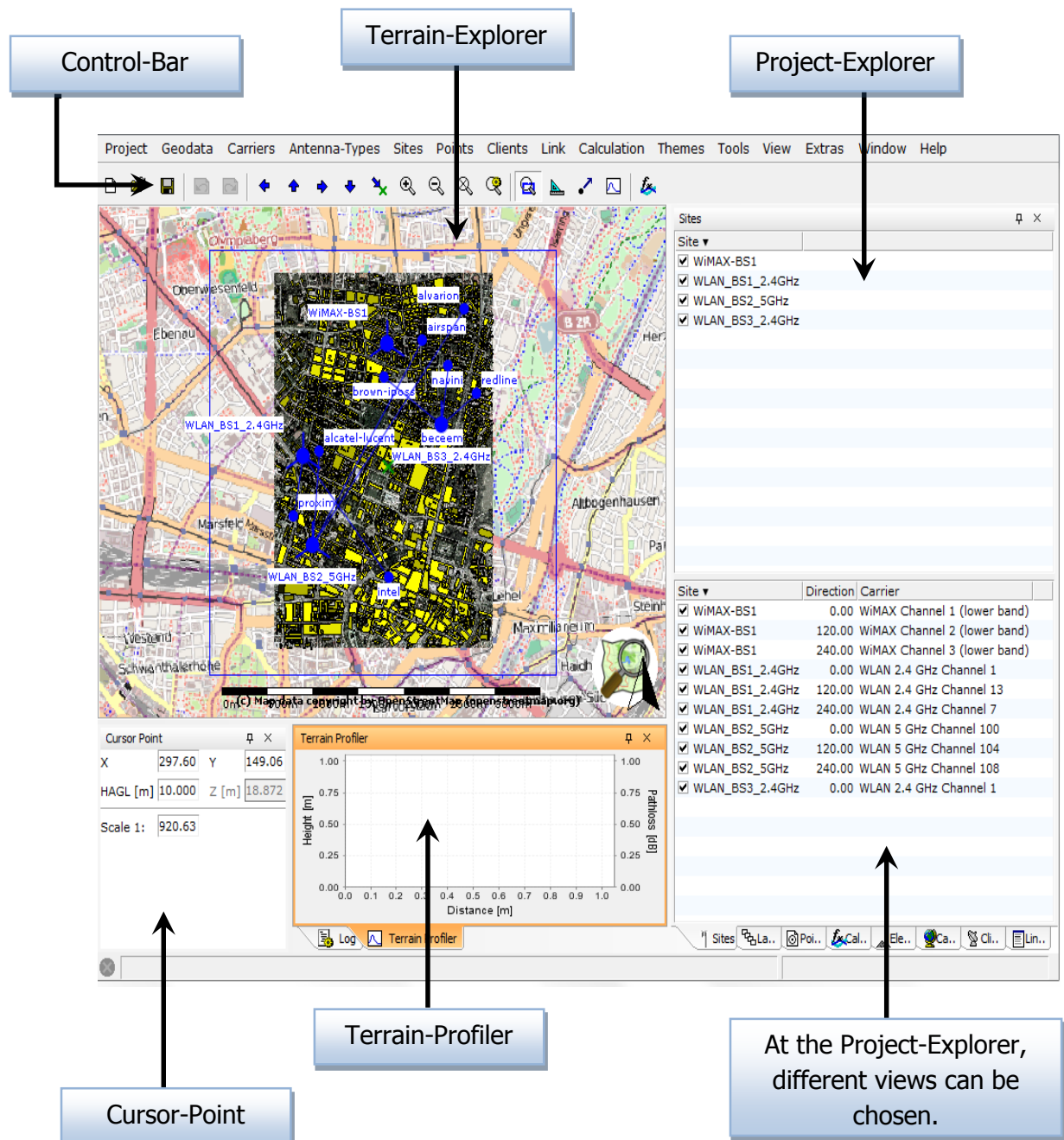


Figure 12: Graphical user interface / Work-Area

Almost all functions can be reached within one or two mouse clicks. The Project-Explorer is on the right side and offers the following views:

- Sites
- Layer
- Points
- Calculation
- Elevation models
- Cadastral data
- Clients
- Link Budget calculation

The view can be changed at every time. At the bottom of the screen the Terrain-Profiler can be found as well as the log and cursor windows. Access the control-bar below the menu bar. The control-bar enables a boundless moving around the terrain, including buttons for all essential functions.

2.2.2 Elements of the Control-Bar



Create a new project. An open project can be saved or discarded.



Load a project from a .rad file. An open project can be saved or discarded.



Save the current project.



One step back. This function affects only changes on the work-area. Calculations and object actions cannot be reverted.



One step forward. This function affects only changes on the work area. Calculations and object actions cannot be reverted.



Shift the visible area to west.



Shift the visible area to north.



Shift the visible area to east.



Shift the visible area to south.



Shift the area to center the cursor.



Scale up the visible area. Options can be found at
Extras→Global Settings→Plot



Scale down the visible area. Options can be found at
Extras→Global Settings→Plot



Optimal adjustment of the visible area. Scales up or down and shift to put all objects to the plot.



★ Centers up the selected object. While activated, objects chosen from the Project-Explorer become centered on the screen.



★★

The rectangle-zoom tool.



★★

The distance/measurement tool.



★★

Simply changes object positions with the drag and drop function.



★★

Activates the Terrain-Profiler.



Opens the field strength area calculation. Now the field strength can be calculated with different propagation models.



Export the plot with components to file or to clipboard

★ **This function can be enabled or disabled.**

★★ **Only one of these functions can be enabled at a time.**

Furthermore, any essential function can be found in the submenus. Detailed explanations can be found in the following chapters. The bulk of the screen is filled with the Terrain-Explorer.

As mentioned, there are four functions run by the left mouse button:

- rectangle zoom
- distance/measurement tool
- Terrain-Profiler
- drag and drop function



For shifting the terrain around without using the arrow buttons in the control bar, push and hold the right mouse button.

There is a legend at the bottom of the Terrain-Explorer which can be enabled or disabled on demand. The blue frame inside the Terrain-Explorer shows the maximum area for calculating a propagation model. This blue frame compiles while creating a new project and cannot be changed subsequently.



Originally the propagation models are calculated for the actual image selection. So it is advisable to choose a larger area for this frame than necessary.

The cursor can be set to a specific point by clicking the left mouse button. This can be instrumental in preventing the user from losing track on large projects.

Use the  function to mark a point to easily return the cursor to at any time or insert coordinates by **Cursor Pointer** and click on **Adjust** to center the map by this coordinates.

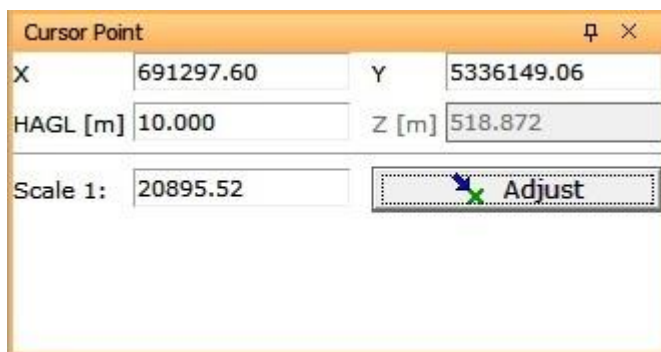


Figure 13: Cursor Pointer

2.2.3 The Rectangle Zoom Tool

The rectangle zoom tool is a useful feature of WiMAP-4G to zoom into the right area on the map.

Just click on the  button on the control bar to activate the rectangle zoom. Choose a point on the map, hold the left mouse button and drag the cursor to mark the exact area.



Figure 14: Zoom



Figure 15: Mark an area

The rectangle zoom tool can also be activated by choosing **Tools→Rectangle Zoom**.

2.2.4 The Distance/Measurement Tool

The distance/measurement tool is useful to get a distance or a specific angle of the map.

Click the  button on the control bar to activate the distance/measurement tool. Choose and click on a desired point on the map with the left mouse button, hold the button and drag the cursor to the desired position.

See the distance and angle difference beside the line that connects the start and target point.

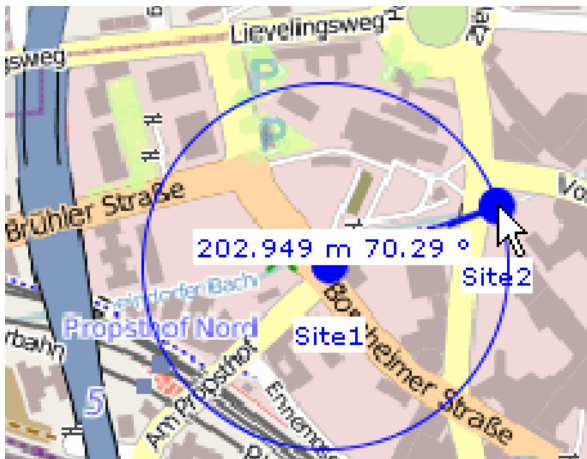


Figure 16: Distance/measurement tool

The distance/measurement tool can also be activated by choosing **Tools→Distance/Angle Measurement**.

2.2.5 The Terrain-Profiler

The Terrain-Profiler is a powerful feature which allows the user to take a snapshot of the environment and watch out for obstacles like mountains or buildings which could interrupt the signal of antennas or disrupt intervisibility. The Terrain-Profiler consists of two parts, the tool itself that can be used to drag around the map and watch out for obstacles and the Terrain-Profiler tab which shows the territory inside the dragged zone. The Terrain-Profiler basically works similar to the distance measurement tool, except the additional tab that shows the territory.

2.2.5.1 How to Use the Terrain-Profiler

1. Click on the  button on the control bar to activate the Terrain-Profiler tool. Click on a desired point on the map, hold the left mouse button and drag the cursor to the desired position.

See the distance and angle difference beside the line that connects the start and target point.

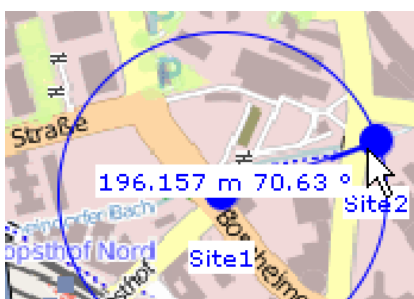


Figure 17: The Terrain-Profiler looks like the distance/measurement tool.

2. For additional information look in the Terrain-Profiler tab which is at the bottom of the WiMAP-4G window by default. The graph in Figure 18 shows how the Terrain-Profiler projects the territory into the Terrain-Profiler tab.

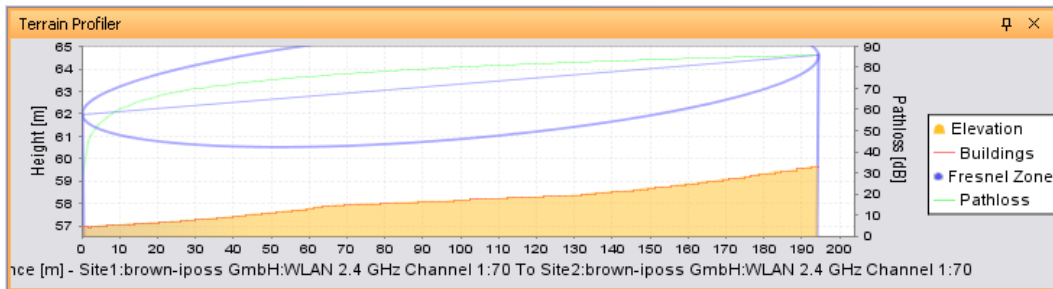


Figure 18: The Terrain-Profiler tab

On the right side of the Terrain-Profiler tab is a legend that shows all relevant information. Elevation, buildings, the Fresnel zone and the pathloss are shown in the Terrain-Profiler tab. The circle will automatically change its color to red if there is any disruption in the Fresnel zone.

This will help the user to see automatically if the desired path is possible or not.

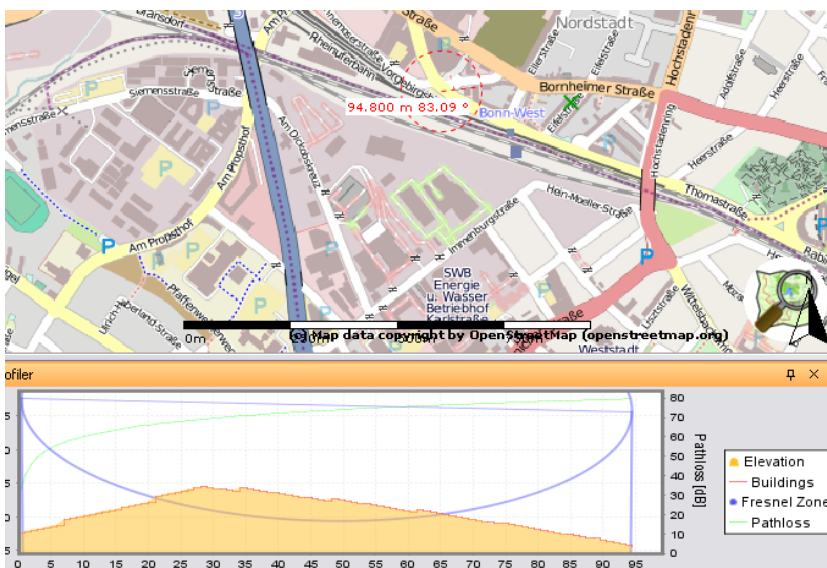


Figure 19: The Fresnel zone is interrupted.

2.2.5.2 Configuring the Terrain-Profiler

The Terrain-Profiler offers a few settings which can be changed to get a better overview and to make the result descriptive for presentations.

*Click on the right mouse button to open a menu that contains the function **Properties**. A click on that button will open the property configuration window.*

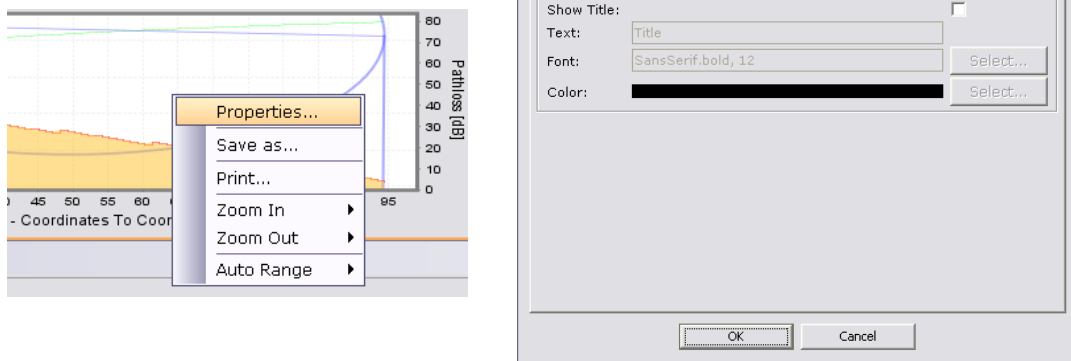


Figure 20: The Terrain-Profiler configuration menu

A figure can be named in the title tab. This could be useful for presentation or further information if the results of the Terrain-Profiler are exported. **Activate** shows the title.

*Enter the desired title in the **Text** field. To choose a font, click on **Select** next to the font field and choose the desired text font, the text size and a format. Click on **Ok** to save the alterations.*

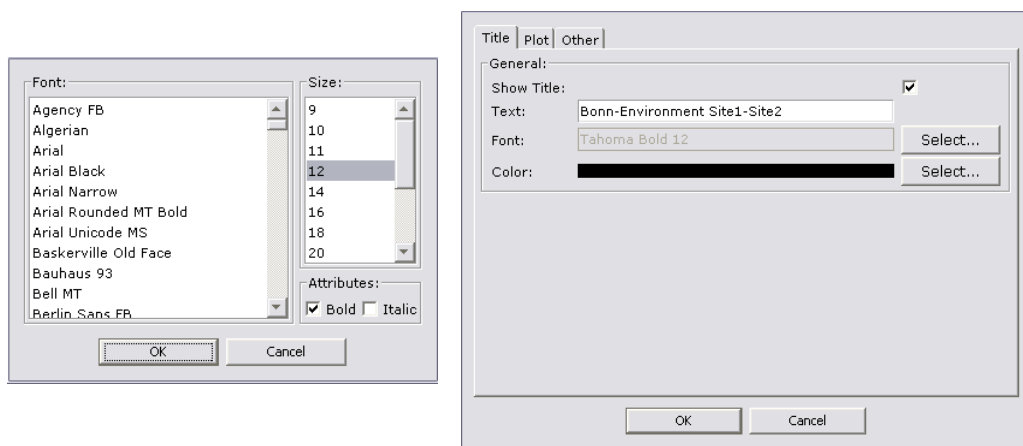


Figure 21: Change title, font and color

*Click on **Plot** tab to make some additional configurations.*

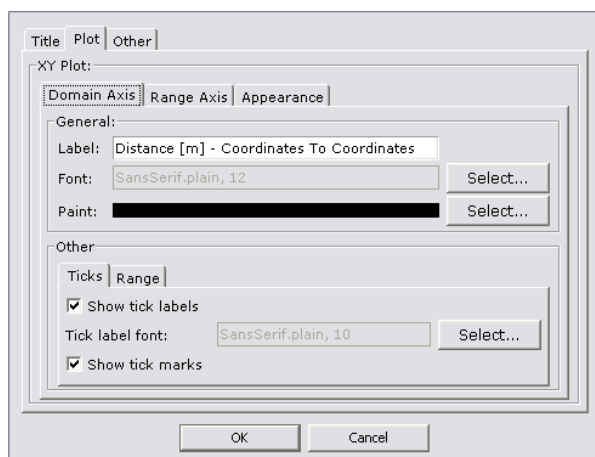


Figure 22: The plot menu

The **Plot** tab contains all settings according to the axes.

*Change the label text by editing the **label** field. Font and text color can also be changed within the tab.*

There are some additional settings provided at the bottom of the window. **Tick labels** can be *enabled or disabled*.

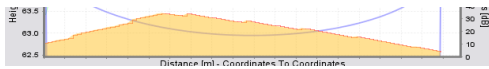


Figure 23: Disabled tick labels

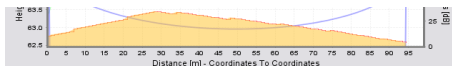


Figure 24: Enabled tick labels

Tick label marks can also be *enabled or disabled*.

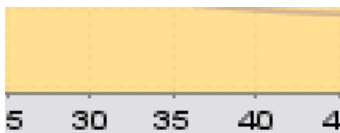


Figure 25: Enabled tick marks



Figure 26: Disabled tick marks

In the **range tab** at the bottom of the window, *the range value can be modified*. If there are no specific circumstances, **auto adjust range** should be activated.

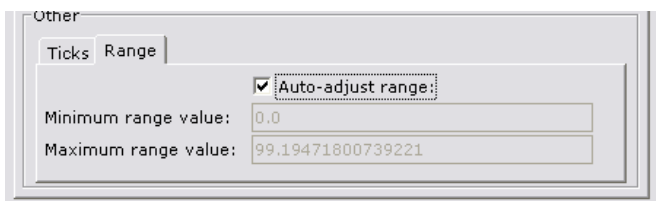


Figure 27: The range tab

All these settings also work for the range axis. At last, there is the **appearance tab** which contains settings to change the layout of the Terrain-Profiler.

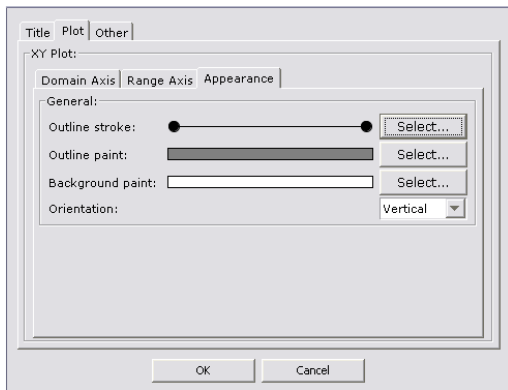


Figure 28: The appearance tab

The **outline stroke** defines the thickness of the outline.

*For changing the colour of the outline click on the **Select** button next to the **Outline paint** row and choose a desired colour.*

The background paint defines the background colour of the plot itself. Preferably pick a neutral colour like white to not interfere the overview. The orientation of the plot can also be changed to vertical or horizontal. The **other** tab offers the following additional settings:

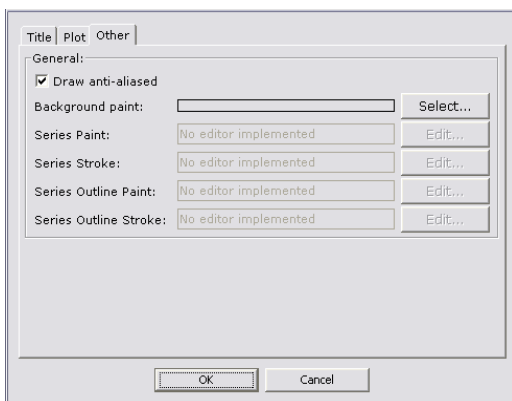


Figure 29: The other tab

Anti-aliasing can be activated or deactivated. If there are no specific circumstances, anti-aliasing should always be enabled.



Figure 30: Anti-aliasing enabled

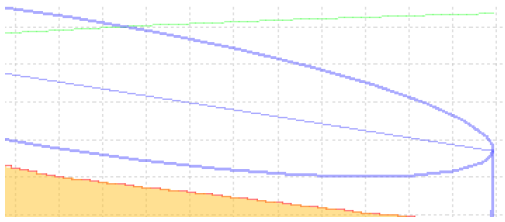


Figure 31: Anti-aliasing disabled

The **background paint** defines the colour of the Terrain-Profiler, not the colour of the plot.

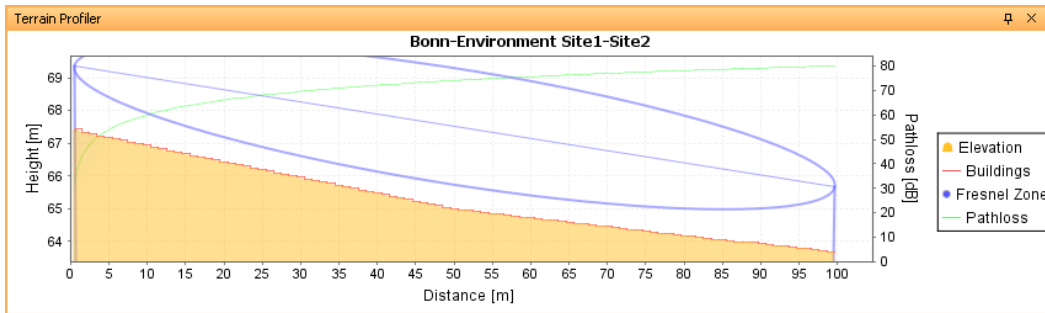


Figure 32: A configured Terrain-Profiler tab

2.2.5.3 Additional Terrain-Profiler Zoom

The Terrain-Profiler offers some additional functions for better analysis. Both axes can be zoomed in/out independently. A *right mouse click* on the **Terrain-Profiler tab** opens the menu that contains all zoom functions.

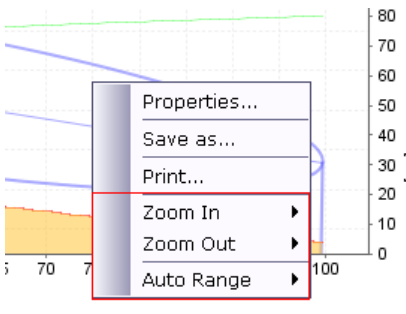


Figure 33: Terrain-Profiler zoom functions

Each zoom submenu contains these three possibilities:

- **both axes:** zooms in/out the full image considering the x/y-ratio
- **domain axis:** zooms in/out the y-axis
- **range axis:** zooms in/out the x-axis

The **auto range submenu** assures that all content of the marked terrain segment is shown.

2.2.5.4 Terrain-Profiler Export Features

Export functions are available for the Terrain-Profiler, too. Results can be printed or exported for other applications or presentations. A *right mouse click* on the **Terrain-Profiler** tab opens the menu window containing the possibilities to **Print** or **Save** the Terrain-Profiler results:

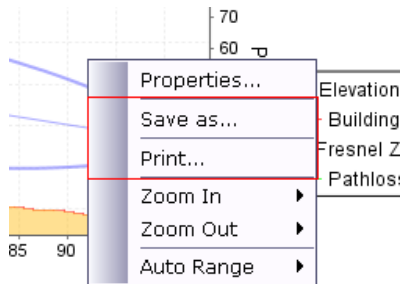


Figure 34: A plot can be saved or printed.

By clicking on **Print**, the printer window opens:

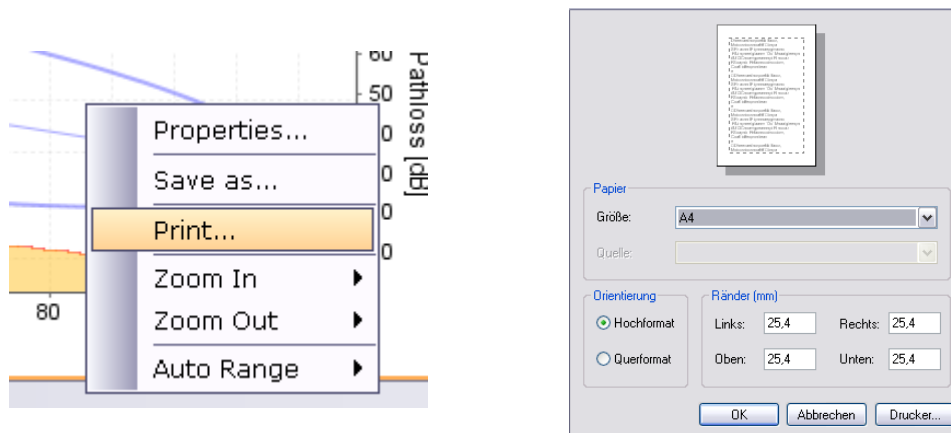


Figure 35: The printer window can have a different look depending on the installed Java version.

Depending on the installed Java version, the window can have different looks, but settings are the same.

After choosing the desired settings, a click on **OK** opens the printer menu.

Printing can be started. Another way to export the Terrain-Profiler results is the **Save as** option which allows the user to store the plot as an image file on his hard drive.

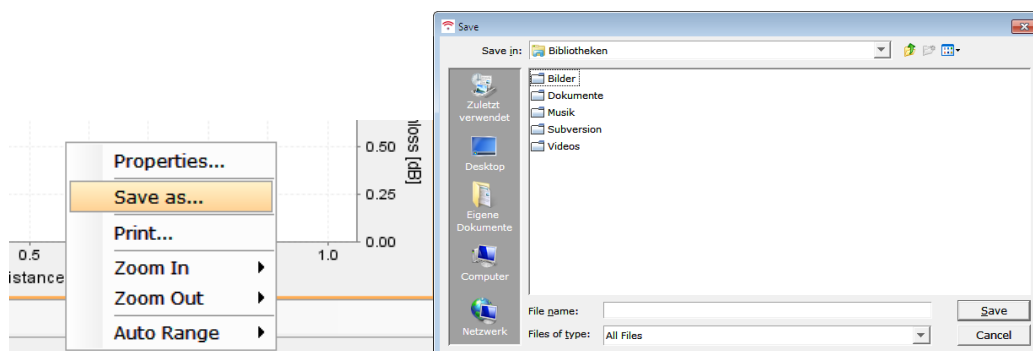


Figure 36: The plot can be saved as a .PNG-file.

After choosing the file path and file name, click on **Save** to store the Terrain-Profiler results in a .png file.

2.3 Customizing the Work Area

There are settings in WiMAP-4G that make work easier. These settings will be explained in this section. Generally WiMAP-4G is designed for working on a large screen. If that is not the case or the user works on a screen with a low resolution, it is necessary to customize the program.

2.3.1 Dock the Windows

The Project-Explorer, the Terrain-Profiler and also the log and cursor window are dockable. *Simple click on*  *forces the windows to dock. When windows are docked, they only expand getting focused by the mouse cursor. This option can be reverted by only one mouse click on*  *or choosing* **Window→Reset Layout** *to reset all windows. The window size can also be changed by simply holding the left mouse button on a border of a window to drag it to the desired size.*

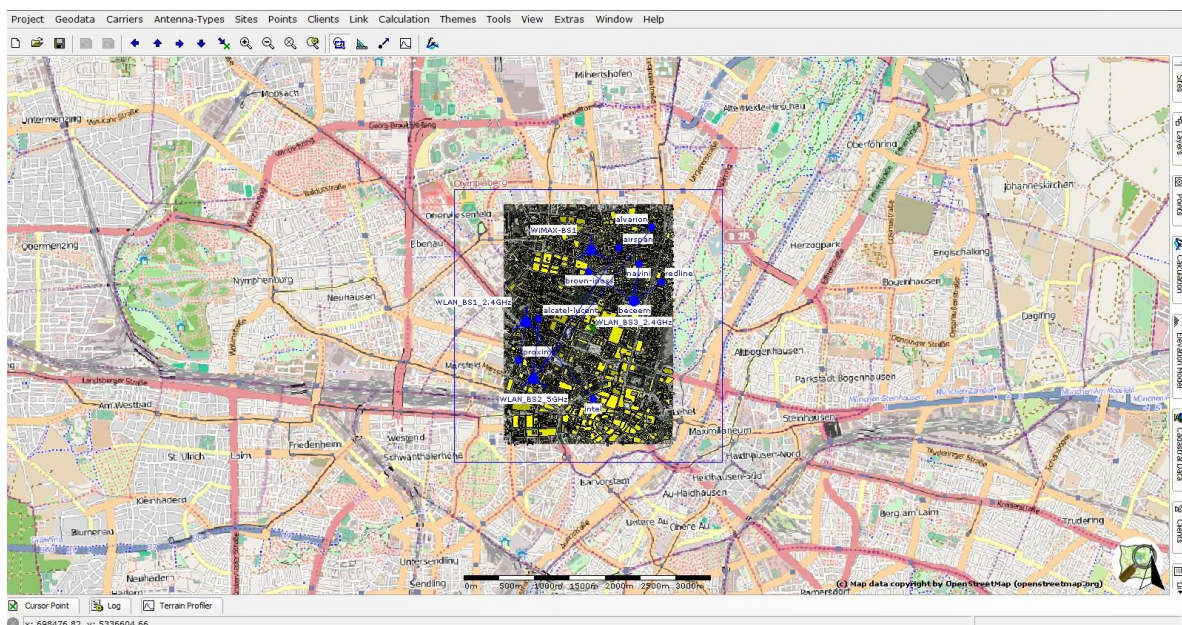


Figure 37: Docking the windows results in a much bigger work area

2.3.2 Adjustment and Zoom Customization

More settings can be found in **Extras→Global Settings**. The following settings can be set up in the submenu **Plot**.

Translation factor: This setting is essential for the four arrows in the control bar. The translation factor gives information about how far the map is shifted by using these arrow-buttons.

A 1 means the whole map is shifted by an entire size of the screen.

A 0.1 means the map is shifted by 10 % of the size of the screen.

Boundary: 0.1 – 10

Zoom factor: The zoom factor option is important for the two zoom button in the control bar. It shows how much the map is up- or downscaled.

A 1 simply means that the map is zoomed in by factor one, so nothing will happen with a 1. Values between 0.1 and 0.9 invert the zoom functions so that the scale up button scales down for example.

With a 1.1 the entire map scales up or down by 10 %.

Boundary: 0.1 - 10

Below, the labels can be configured to show objects and/or antennas colored black and buildings gray. There is also an option for the intelligent label arrangement which gives the program the privilege to ignore the label standards if necessary.

The size of pixel and labels can be changed in the submenu medium. Label size can be changed between 0.5 and 30 mm variably. The pixel size should only be changed if presentation errors occur.

It is possible to change position and visibility of the Legend in the submenu **Legend**.

2.4 Link Budget

The link budget is the accounting of all the losses and gains during a transmission inside the medium, antennas, cable etc. The way to calculate the link budget basically is:

Received Power = Transmitted Power + Gains – Losses

WiMAP-4G offers many parameters for the link budget calculation and therefore the most precise result is guaranteed.

The following parameters can be adjusted:

- **Max. Total Power:** Maximum power of the base station
- **Max. Pilot Power:** Maximum pilot power of the base station
- **Antenna Gain Tx:** Antenna gain for the specific transmission (vertical and horizontal tilt involved)
- **Cable Loss Tx:** The used cables loss
- **Tx Loss:** The power which could get lost between two transmission points
- **EIRP:** Equivalent isotropically radiated power (the result)
- **Noise Density:** Noise power per unit of bandwidth
- **Noise Figure Rx:** Difference between the output of the receiver and the output of an ideal receiver with same gain

- **Signal Bandwidth:** Signal bandwidth from the carrier
- **Rx Loss:** Receive loss between the stations
- **Required C/I:** The minimum desired C/I
- **Rx Sensitivity:** The minimum signal power that is needed to create the required SNR
- **Antenna Gain Rx:** Antenna gain TX of the corresponding station
- **Cable Loss Rx:** Cable loss of the corresponding station
- **Total available path loss:** Maximum path loss between stations
- **Own source interference:** Interference from the sending antenna itself
- **Own source interference margin:** Interference margin from the sending antenna itself
- **Fast fading margin:** Margin required to compensate fades
- **Log normal fading margin:** Margin to guarantee coverage probability
- **Indoor Loss:** Loss caused by walls or vehicles
- **Environmental Loss:** Loss caused by the environment
- **Performance Gains:** Performance gains added with special antennas or configurations
- **Max. permitted propagation loss:** Result of total available path loss and dimensioning parameters
- **Free Space cell range:** Maximum cell range using Free Space Propagation
- **Erceg C cell range:** Maximum cell range using Erceg propagation model
- **Carrier Frequency:** Frequency used by the antennas (2.4 GHz, 5.4 GHz ...)

Link Budget		
Transmitter Unit		
Max. Total Power [dBm]	0.000	0.000
Max. Pilot Power [dBm]	0.000	0.000
Antenna Gain Tx [dBi]	0.000	0.000
Cable Loss Tx [dB]	0.000	0.000
Tx Loss [dB]	0.000	0.000
EIRP [dBm]	0.000	0.000
Receiver Unit		
Noise Density [dBm/Hz]	-174.000	-174.000
Noise Figure Rx [dB]	3.000	3.000
Signal Bandwidth [MHz]	0.000	0.000
Rx Loss [dB]	0.000	0.000
Required C/I [dB]	6.000	6.000
RX Sensitivity [dBm]		
Antenna Gain Rx [dBi]	0.000	0.000
Cable Loss Rx [dB]	0.000	0.000
Total available path loss [dB]		
Dimensioning		
Own source interference [%]	0.00	0.00
Other source interf. margin [dB]	3.000	3.000
Fast fading margin [dB]	4.000	4.000
Log normal fading margin [dB]	7.000	7.000
Indoor Loss [dB]	10.000	10.000
Environmental Loss [dB]	3.000	3.000
Performance Gains [dB]	0.000	0.000
Max. permitted prop. loss [dB]		
Free-Space cell range [m]		
Erceg C cell range [m]		
Carrier Frequency [MHz]	3500.000	
Refresh Adjust Antennas		

Figure 38: The link budget tab



2.4.1 How to Make a Link Budget Calculation

Basically there are two different methods to make a link budget calculation: Use the Terrain-Profiler to make a calculation or calculate manually. The manual way is useful to make calculations that cannot be done with the Terrain-Profiler or ad-hoc calculations without having planned any sites, antennas, etc.

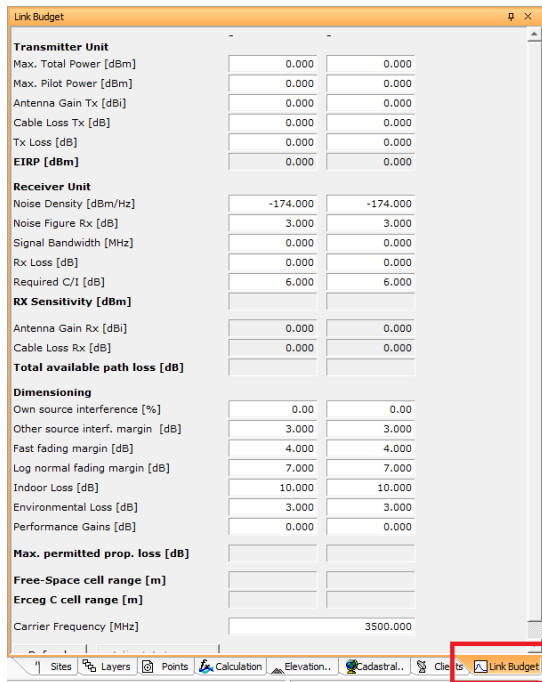
2.4.1.1 Manually

1. Open the link budget calculation tab in the Project-Explorer or choose **Link→Link Budget**.

2. Enter the corresponding values into the link budget tab.

Existing values are set by default while starting the link budget calculation to match the standard values for the corresponding parameter. Do not change these parameters if you are not sure what they do or which more specific values could match your special case.

3. WiMAP-4G automatically changes the results while you insert the values.



Transmitter Unit		
Max. Total Power [dBm]	0.000	0.000
Max. Pilot Power [dBm]	0.000	0.000
Antenna Gain Tx [dBi]	0.000	0.000
Cable Loss Tx [dB]	0.000	0.000
Tx Loss [dB]	0.000	0.000
EIRP [dBm]	0.000	0.000
Receiver Unit		
Noise Density [dBm/Hz]	-174.000	-174.000
Noise Figure Rx [dB]	3.000	3.000
Signal Bandwidth [MHz]	0.000	0.000
Rx Loss [dB]	0.000	0.000
Required C/I [dB]	6.000	6.000
RX Sensitivity [dBm]		
Antenna Gain Rx [dBi]	0.000	0.000
Cable Loss Rx [dB]	0.000	0.000
Total available path loss [dB]		
Dimensioning		
Own source interference [%]	0.00	0.00
Other source interf. margin [dB]	3.000	3.000
Fast fading margin [dB]	4.000	4.000
Log normal fading margin [dB]	7.000	7.000
Indoor Loss [dB]	10.000	10.000
Environmental Loss [dB]	3.000	3.000
Performance Gains [dB]	0.000	0.000
Max. permitted prop. loss [dB]		
Free-Space cell range [m]		
Ercege C cell range [m]		
Carrier Frequency [MHz]	3500.000	

Figure 39: The link budget tab

2.4.1.2 Automatically by Using the Terrain-Profiler

To calculate the link budget automatically, two sites need to be created.

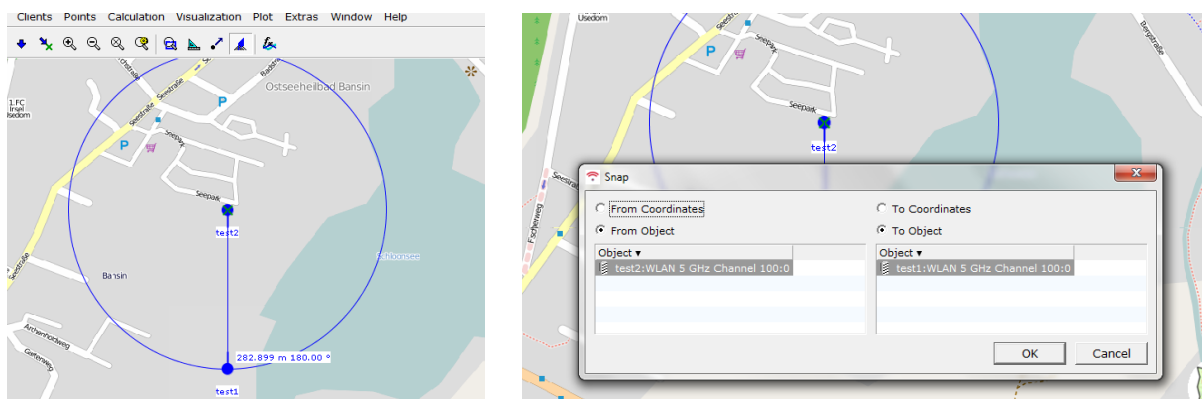


Figure 40: The snap window appears after connecting two points.

1. Choose the **Terrain-Profiler**, click on the first station and drag the mouse cursor to the desired second station. Click the mouse button to open the snap window. Now choose between **coordinate** or **object**.

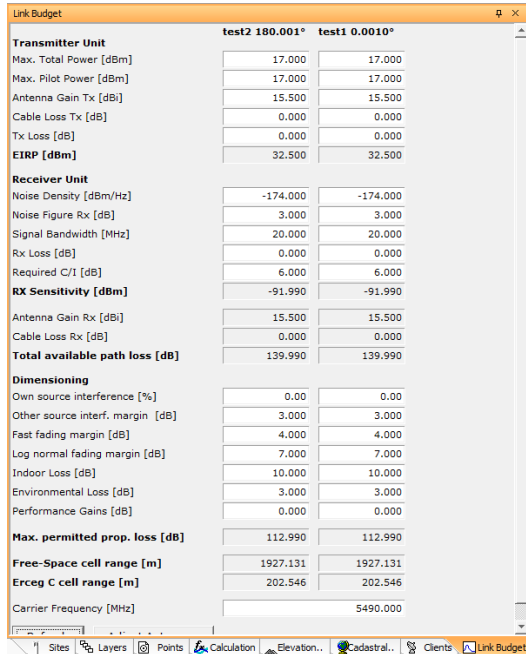
The easiest way to calculate the link budget of two stations is to drag the Terrain-Profiler from one object to another and to pick both objects in the snap window.

2. After choosing **objects** or **coordinates**, click on **OK** to start the link budget calculation.

The values for the two objects are inserted automatically - the calculation is done. Manual adjustments are possible only for the default values and the dimensioning parameters. All values that have been gathered from the stations cannot be edited.

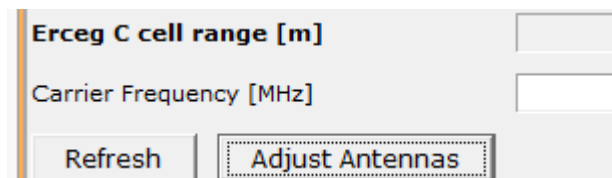
Find the button **Adjust Antennas** in the upper left corner of the link calculation tab. Click

on this button and the antennas of the stations will be adjusted automatically by WiMAP-4G to guarantee the best results for the link budget calculation and also for common. It is not recommended to adjust the antennas if they have already been planned for a specific scenario. With these adjustments the link budget seems to look better but hence problems can occur. If an adjustment is made for the antennas or the stations, click on the **Refresh** button in the upper left corner to assign these new values to the link budget calculation.



	test2 180.001°	test1 0.0010°
Transmitter Unit		
Max. Total Power [dBm]	17.000	17.000
Max. Pilot Power [dBm]	17.000	17.000
Antenna Gain Tx [dBi]	15.500	15.500
Cable Loss Tx [dB]	0.000	0.000
Tx Loss [dB]	0.000	0.000
EIRP [dBm]	32.500	32.500
Receiver Unit		
Noise Density [dBm/Hz]	-174.000	-174.000
Noise Figure Rx [dB]	3.000	3.000
Signal Bandwidth [MHz]	20.000	20.000
Rx Loss [dB]	0.000	0.000
Required C/I [dB]	6.000	6.000
RX Sensitivity [dBm]	-91.990	-91.990
Antenna Gain Rx [dBi]	15.500	15.500
Cable Loss Rx [dB]	0.000	0.000
Total available path loss [dB]	139.990	139.990
Dimensioning		
Own source interference [%]	0.00	0.00
Other source interf. margin [dB]	3.000	3.000
Fast fading margin [dB]	4.000	4.000
Log normal fading margin [dB]	7.000	7.000
Indoor Loss [dB]	10.000	10.000
Environmental Loss [dB]	3.000	3.000
Performance Gains [dB]	0.000	0.000
Max. permitted prop. loss [dB]	112.990	112.990
Free-Space cell range [m]	1927.131	1927.131
Erceg C cell range [m]	202.546	202.546
Carrier Frequency [MHz]		5490.000

Figure 41: WiMAP-4G automatically enters

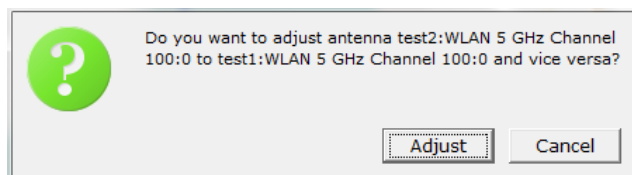


Erceg C cell range [m]

Carrier Frequency [MHz]

Refresh Adjust Antennas

Figure 42: The adjust antennas button



Do you want to adjust antenna test2:WLAN 5 GHz Channel 100:0 to test1:WLAN 5 GHz Channel 100:0 and vice versa?

Adjust Cancel

Figure 43: Adjustments need confirmation

2.4.2 The log

The log is an useful tool to help the user identify problems if something does not work. It is a separate window and therefore it can be observed while working in the program. The log can be found at the bottom of the user interface of WiMAP-4G (by default).

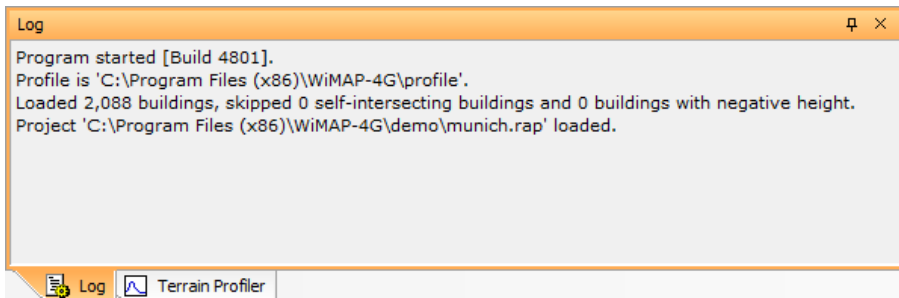


Figure 44: The log window

After loading a project, the log starts protocolling everything for a better overview to relate to every step of the work. Nearly every action of the log except interface actions will be protocolled, for example shifting the area or zooming in and out. To learn what happened or what caused a problem take a look at the log first. Errors are written in red colour for better identification. The warning messages are highlighted in blue.

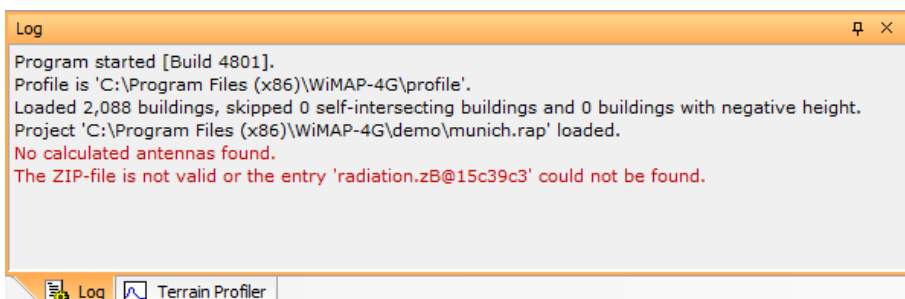


Figure 45: Errors are shown in red in the log window.

2.5 The Project-Explorer

The **Project-Explorer** combines every object used in the actual project for a quite good overview. Each created, edited or imported case can be found in the Project-Explorer for detailed actions.

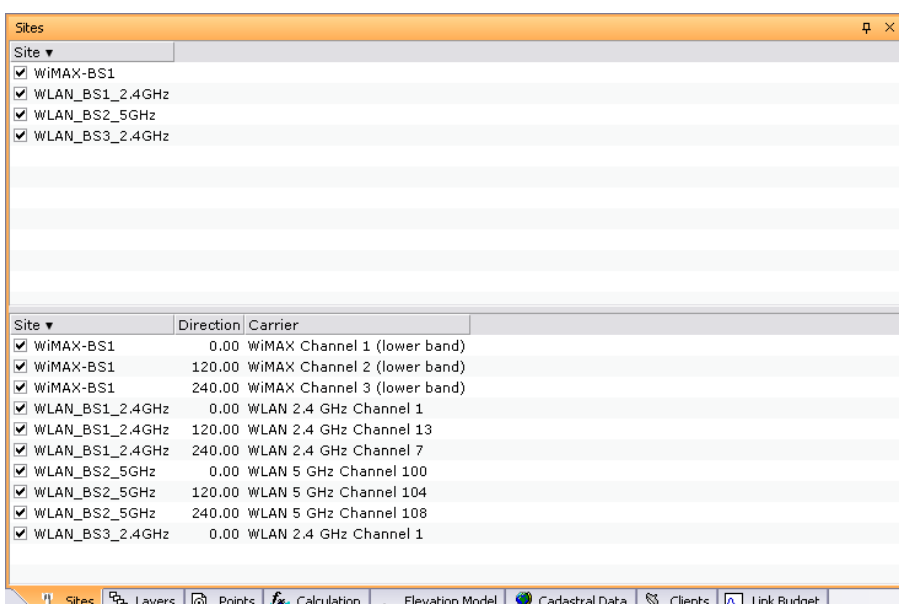


Figure 46: The Project-Explorer

The following tabs can be found in the **Project-Explorer**:

- Sites
- Layers
- Points
- Calculation
- Elevation model
- Cadastral data
- Clients
- Link budget calculation

Every tab is designed individually to offer a good orientation and to keep all actions as simple as possible.

2.5.1 The Sites Tab

The **sites tab** in the **Project-Explorer** give an overview of all sites and antennas used in the project.

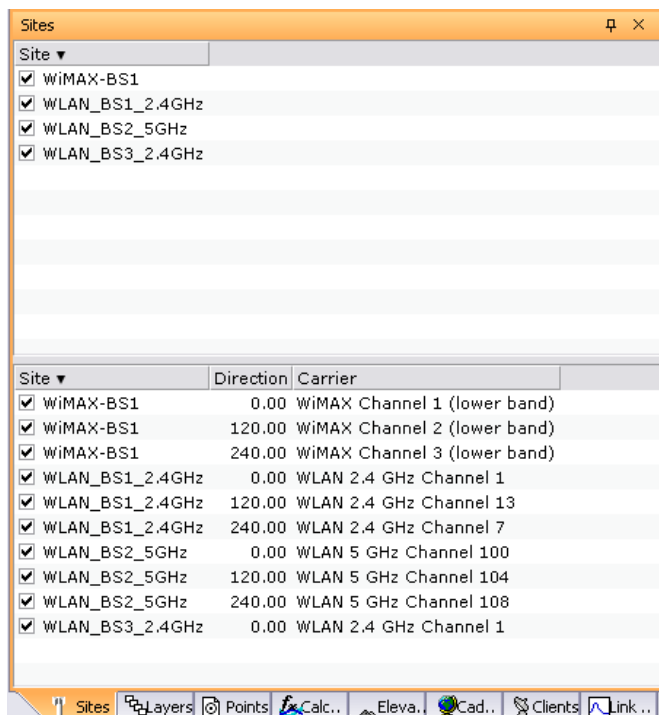


Figure 47: The sites tab

The upper part of the **sites tab** shows all sites used in the project.

Right click on a site offers a few options for creation, deletion etc. The lower part of the **sites tab** shows all the antennas used in the project with their corresponding sites and used carriers.

Right click on an antenna offers the possibilities to delete or edit antennas. Creation of antennas is not possible because the antennas are placed on a site.

To create antennas, right click the desired site and choose edit. More information can be found in the corresponding chapter in this manual. Sites and antennas can be activated or deactivated just by *checking or unchecking the boxes beside the desired antenna or site.*

2.5.2 The Layers Tab

The important thing to understand while working with WiMAP-4G is all things managed by the program are organized in layers and can be deactivated or activated as desired. Layers will be created in WiMAP-4G for every single case created or edited by program: buildings, calculations, elevation, sites, clients, points etc.

In the **Project-Explorer** of the **layers tab**, all layers are listed.

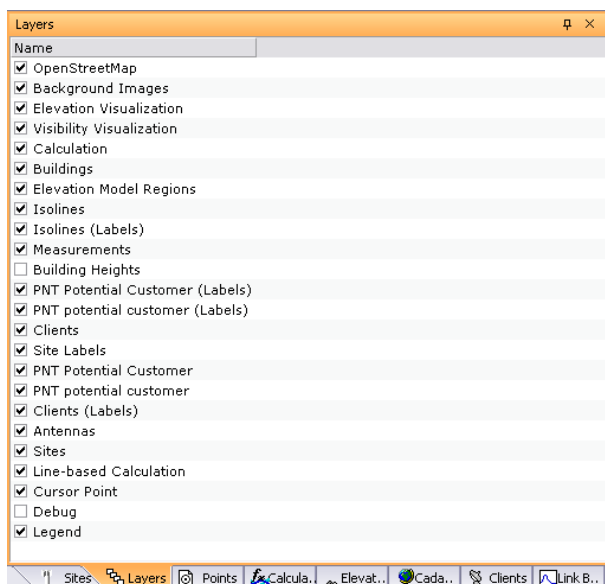


Figure 48: The layers tab

In Figure 48 you can see the **layers tab** in the **Project-Explorer**, except debug and building heights everything is activated.

To deactivate a layer simply uncheck the box next to the layer name. Layers will be created automatically while performing actions such as calculations or building creation. The layers given in this example are the standard layers preconfigured for every project. Not all of them are used while creating a new project.

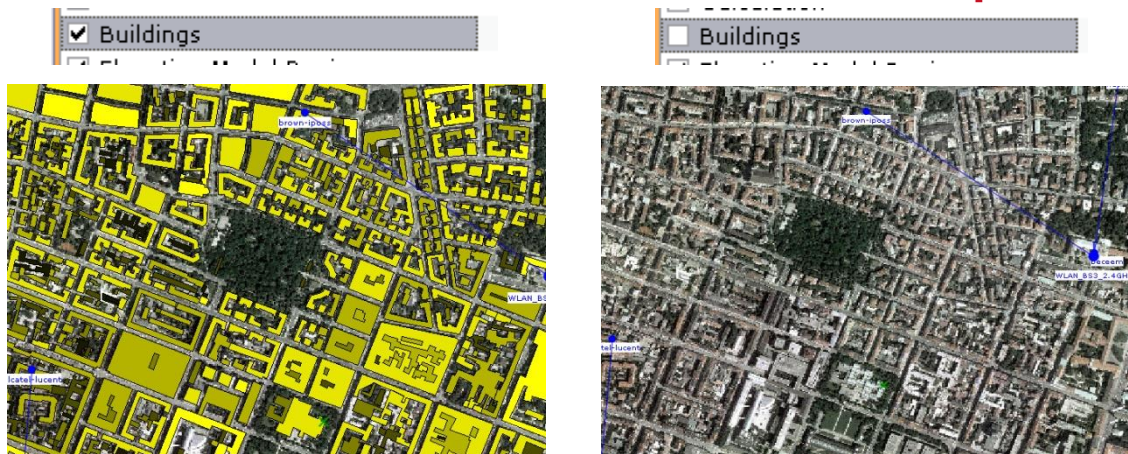


Figure 49: Buildings layer enabled and disabled

2.5.3 The Points Tab

The **points tab** has three subtabs: list, coverage and visualisation. The list tab shows all points used in the project sorted by the point category. Points can be activated or deactivated. If the used points are not listed in the points tab, make sure to choose the correct point category.

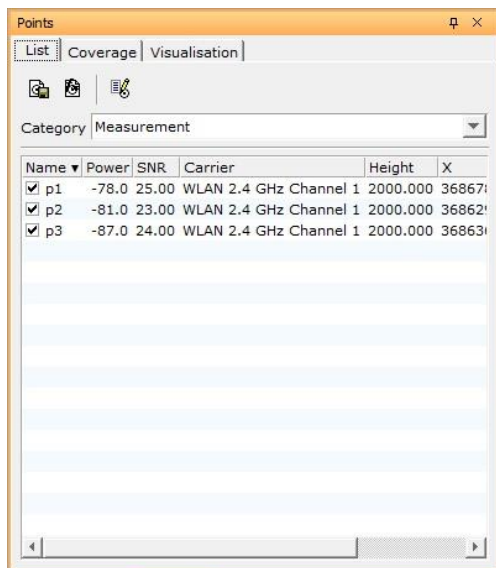


Figure 50: The points tab – list tab

A right click on a point offers the possibilities to create, edit or delete a point. The little icons in the right upper corner allow export and calculation of the points and gives the possibility to edit the point classes. More information can be found in the corresponding chapter in this manual.

The coverage tab is for showing the colour of coverage levels based on the colour diagram of the carrier.

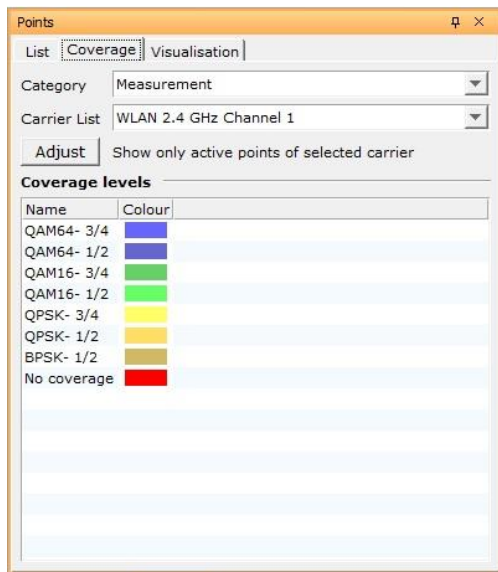


Figure 51: The points tab – coverage tab

The visualisation tab is for colouring points based on the *category*, the *parameter* that is visualized and the *colouring* which are shown in a table by *Intervals*. With one click on *Adjust* the colour is set. With *Reset* colour settings are restored back to the latter colouring.

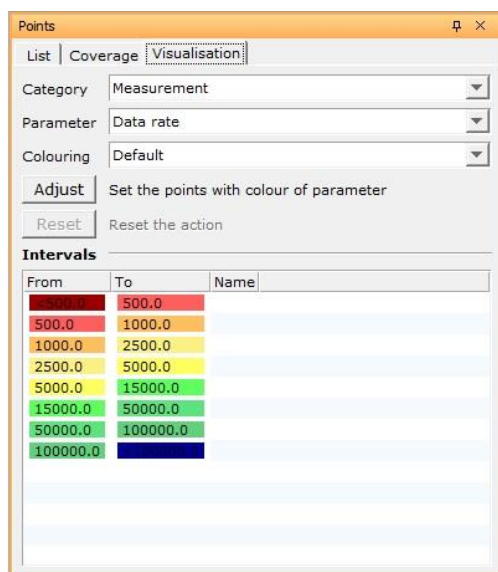


Figure 52: The points tab – visualisation tab

2.5.4 The Calculation Tab

The **calculation tab** is one of the most important tabs and shows all done calculation in the actual project.

If a calculation is done, all sites and antennas used in this calculation will show up in the **calculation tab**. Single sites or antennas can be activated or deactivated for getting better calculation results or even finding an interfering one. The upper part of the calculation tab offers all important calculations that are possible with WiMAP-4G.

Right click on sites or antennas offers many features described in corresponding chapters of this manual.

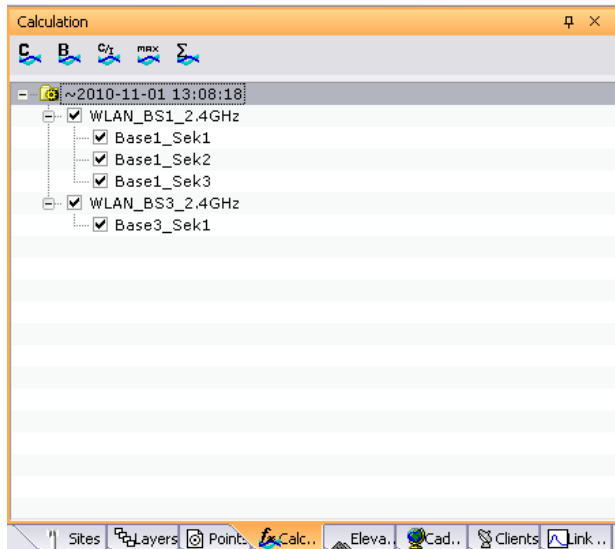


Figure 53: The calculation tab

2.5.5 The Elevation Model Tab

The **elevation model tab** shows all elevation data that is used in the actual project. The elevation model file name and the file path are shown.

A right click on an elevation model file offers the possibility to unload the file. More information about elevation models, elevation model import and editing elevation models can be found in the corresponding chapters of this manual.

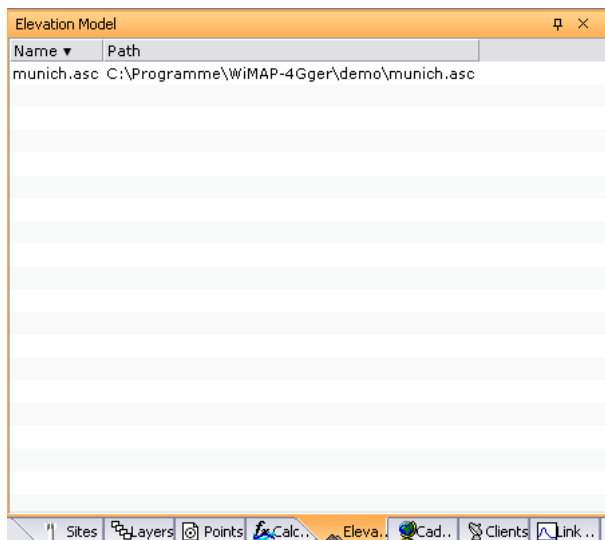


Figure 54: The elevation model tab

2.5.6 The Cadastral Data Tab

The **cadastral data tab** shows all the cadastral data that is used in the actual project. The cadastral data file name and the file path are shown.

A right click on a cadastral data file offers the possibility to unload this file. More information about cadastral data and cadastral data import can be found in the corresponding chapters of this manual.

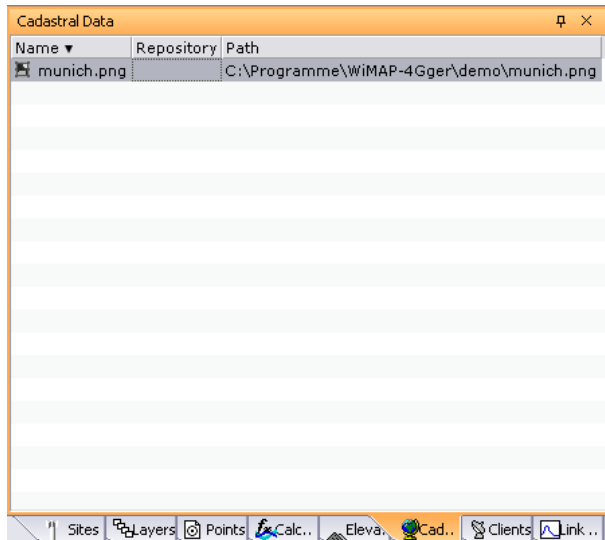
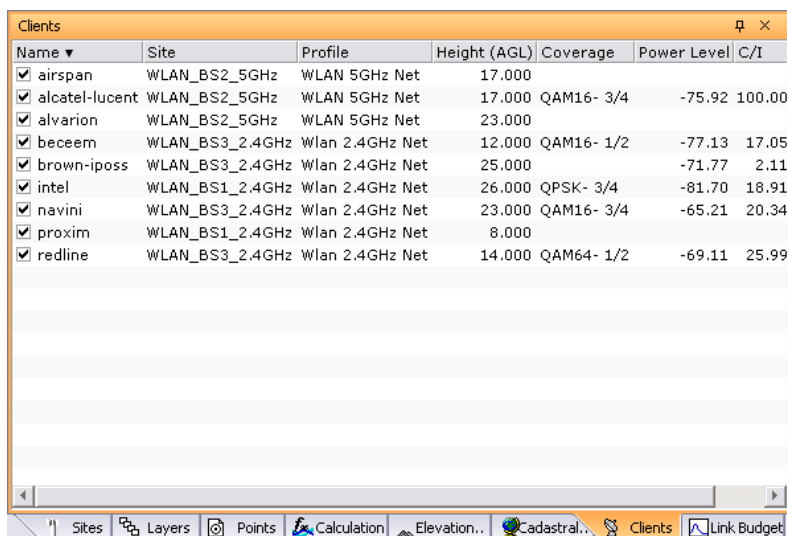


Figure 55: The cadastral data tab

2.5.7 The Clients Tab

The **clients tab** shows all created clients in the actual project with their corresponding profile, height, coverage, power level and carrier to interfere values.

A right click on a client offers all the possibilities to create, edit or delete the client and to choose the Terrain-Explorer to show the environment between the client and his corresponding site. More information about clients and associated possible actions can be found in the corresponding chapters of this manual.



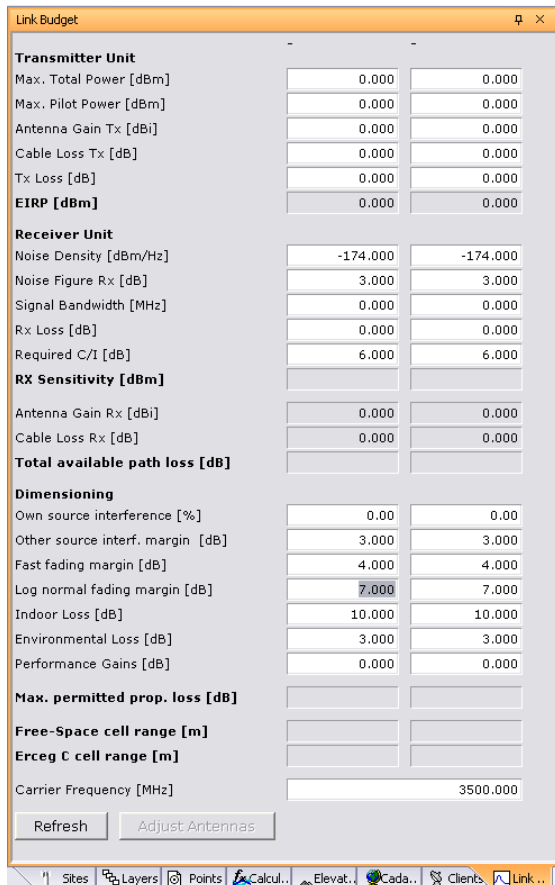
Name ▼	Site	Profile	Height (AGL)	Coverage	Power Level	C/I
☒ airspan	WLAN_BS2_5GHz	WLAN 5GHz Net	17.000			
☒ alcatel-lucent	WLAN_BS2_5GHz	WLAN 5GHz Net	17.000	QAM16- 3/4	-75.92	100.00
☒ alvarion	WLAN_BS2_5GHz	WLAN 5GHz Net	23.000			
☒ beceem	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	12.000	QAM16- 1/2	-77.13	17.05
☒ brown-iposs	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	25.000		-71.77	2.11
☒ intel	WLAN_BS1_2.4GHz	Wlan 2.4GHz Net	26.000	QPSK- 3/4	-81.70	18.91
☒ navini	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	23.000	QAM16- 3/4	-65.21	20.34
☒ proxim	WLAN_BS1_2.4GHz	Wlan 2.4GHz Net	8.000			
☒ redline	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	14.000	QAM64- 1/2	-69.11	25.99

Figure 56: The clients tab

2.5.8 The Link Budget Tab

The **link budget tab** offers the user the possibility to calculate a detailed link budget for a desired situation.

Many variables can be inserted to guarantee the most precise results. The **link budget tab** will be explained later in this manual so take a look on the corresponding chapters.



Transmitter Unit	
Max. Total Power [dBm]	0.000
Max. Pilot Power [dBm]	0.000
Antenna Gain Tx [dBi]	0.000
Cable Loss Tx [dB]	0.000
Tx Loss [dB]	0.000
EIRP [dBm]	0.000

Receiver Unit	
Noise Density [dBm/Hz]	-174.000
Noise Figure Rx [dB]	3.000
Signal Bandwidth [MHz]	0.000
Rx Loss [dB]	0.000
Required C/I [dB]	6.000
RX Sensitivity [dBm]	
Antenna Gain Rx [dBi]	0.000
Cable Loss Rx [dB]	0.000
Total available path loss [dB]	

Dimensioning	
Own source interference [%]	0.00
Other source interf. margin [dB]	3.000
Fast fading margin [dB]	4.000
Log normal fading margin [dB]	7.000
Indoor Loss [dB]	10.000
Environmental Loss [dB]	3.000
Performance Gains [dB]	0.000

Max. permitted prop. loss [dB]	

Free-Space cell range [m]	

Erceg C cell range [m]	

Carrier Frequency [MHz]	
	3500.000

Figure 57: The link budget tab

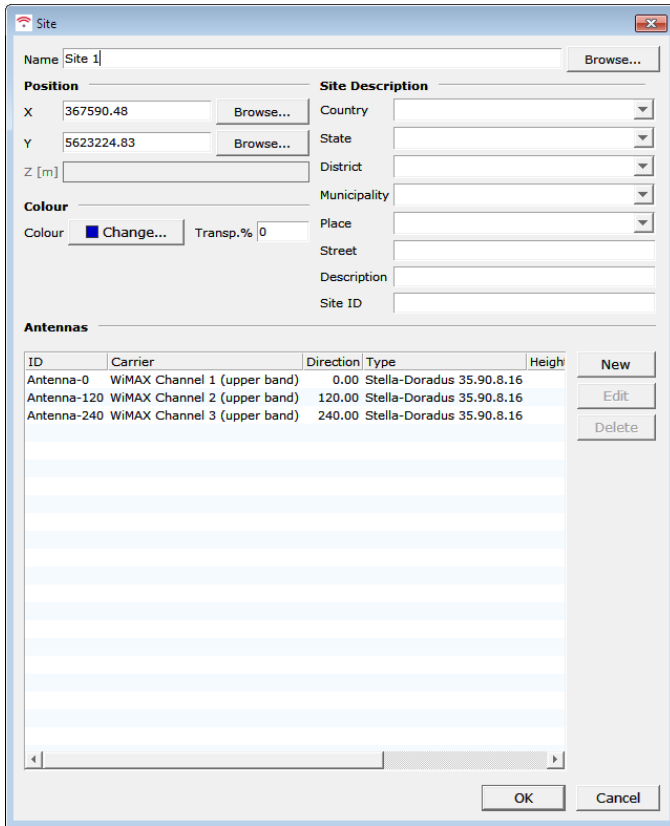
2.6 Colour

Sites, antennas and points can be coloured for a better overview. For example in the demo project "Munich" can be changed the colour of sites and antennas.



2.6.1 How to make a Site coloured

1. Open the setting of a Site or create a new Site.



Site

Name: Site 1 Browse...

Position

X: 367590.48 Browse...

Y: 5623224.83 Browse...

Z [m]:

Colour

Colour: Change... Transp.%: 0

Site Description

Country:

State:

District:

Municipality:

Place:

Street:

Description:

Site ID:

Antennas

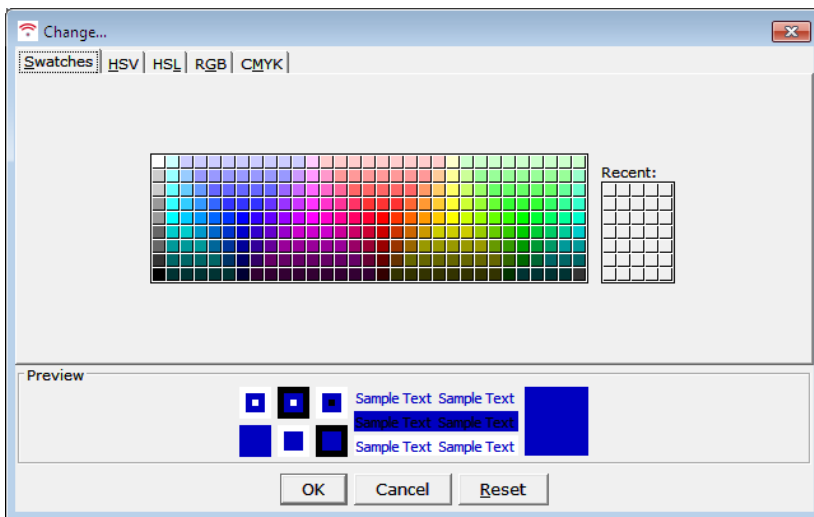
ID	Carrier	Direction	Type	Height
Antenna-0	WiMAX Channel 1 (upper band)	0.00	Stella-Doradus	35.90.8.16
Antenna-120	WiMAX Channel 2 (upper band)	120.00	Stella-Doradus	35.90.8.16
Antenna-240	WiMAX Channel 3 (upper band)	240.00	Stella-Doradus	35.90.8.16

New Edit Delete

OK Cancel

Figure 58: Settings of a Site

2. Under the heading **Colour** the colour and the transparency can be changed (in %). Click on *Change...* to change the colour.



Change...

Swatches HSV HSL RGB CMYK

Recent:

Preview

OK Cancel Reset

Figure 59: Select the colour

3. Select your new colour, click on OK and click by Site again on OK. Now your selected site is in your colour.

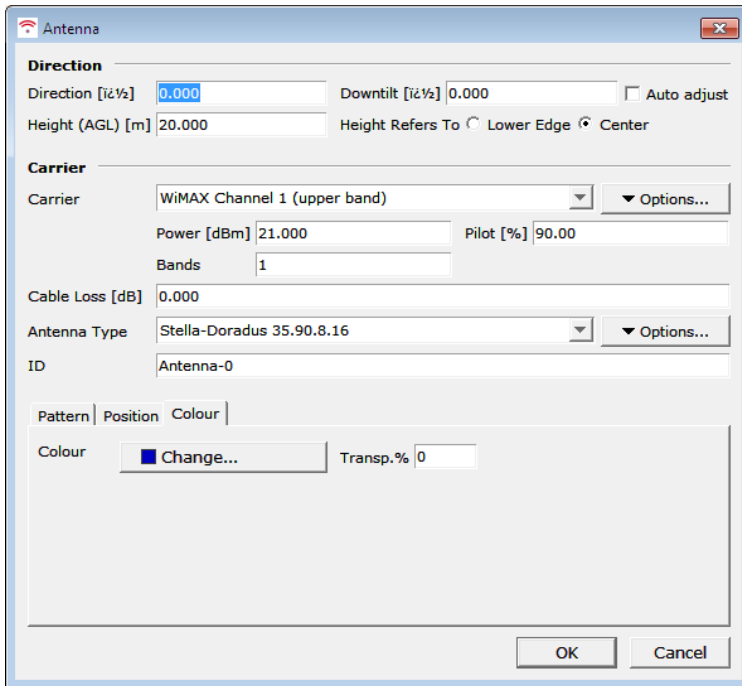


The colour of clients are changed to the colour of the site automatically.



2.6.2 How to make an Antenna coloured

1. Open the setting of a site or select the antenna in the site tab and take a right click on the antenna and select *Edit* or open in action-bar *Antenna-Types*→*Edit* (Here, you can only change the basic settings of an antenna type).



The image shows a screenshot of the 'Antenna' settings dialog box. The dialog is titled 'Antenna' and has a close button (X) in the top right corner. It is divided into several sections:

- Direction:** Contains fields for 'Direction [1/4°]' (set to 0.000), 'Downtilt [1/4°]' (set to 0.000), and 'Height (AGL) [m]' (set to 20.000). There is also a checkbox for 'Auto adjust' and a radio button for 'Height Refers To' (set to 'Center').
- Carrier:** Contains a dropdown for 'Carrier' (set to 'WiMAX Channel 1 (upper band)'), a 'Power [dBm]' field (set to 21.000), a 'Pilot [%]' field (set to 90.00), and a 'Bands' field (set to 1). There is an 'Options...' button next to the carrier dropdown.
- Cable Loss [dB]:** A field set to 0.000.
- Antenna Type:** A dropdown set to 'Stella-Doradus 35.90.8.16' with an 'Options...' button.
- ID:** A field set to 'Antenna-0'.
- Pattern | Position | Colour:** A tabbed interface. The 'Colour' tab is active, showing a 'Colour' field with a blue square and a 'Change...' button, and a 'Transp. %' field set to 0.

At the bottom of the dialog are 'OK' and 'Cancel' buttons.

Figure 60: Antenna settings

2. Under the Option **Color** can be change the color and the transparency (in %). Click on *Change...* to change the color.

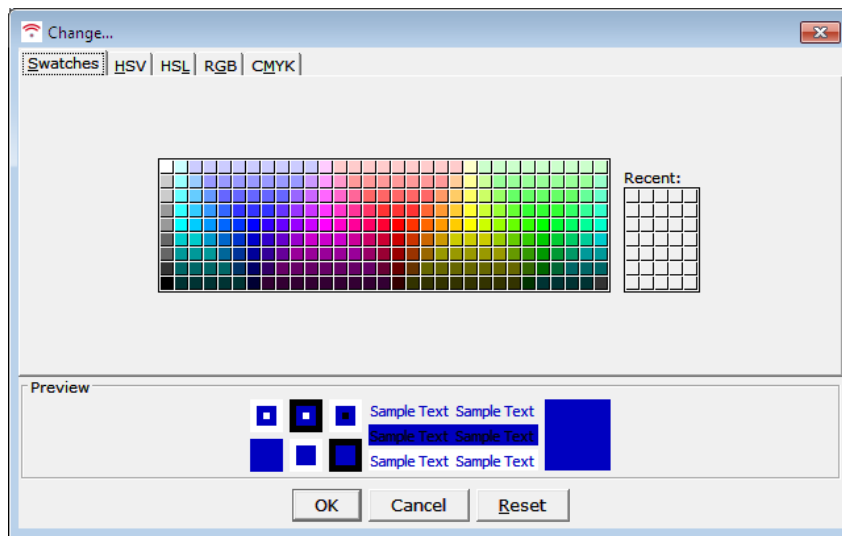


Figure 61: Select the colour

3. Select your new colour, click on OK and click by Site again on OK. Now your selected antenna is displayed in the colour of your choice.



To change multiple antennas or sites look at 7.1.8.1

2.6.3 How to make a point coloured

Look at chapter 8.6.

3 Projects

3.1 Project Settings

Before creating a new project, some adjustments should be done. Extensive adjustments can be made in **Project→Properties** and **Extras→Project Defaults**. The properties refer to the actual project in case it is already open. **Project defaults** are pre-configured settings. It is easier to use those than configure every single project individually. However the layout is the same for both.

3.1.1 General

The following coordinate system types can be chosen:

- UTM (Universal Transverse Mercator)
- Gauss-Krueger
- Geographic

By choosing UTM or Gauss-Krueger a start zone/stripe from the coordinate system can be selected. The earth is scaled in 60 stripes, Germany is in stripe 32 for example. The cursor is placed on the chosen zone at equator level. The coordinate system type can also be chosen while creating a new project.

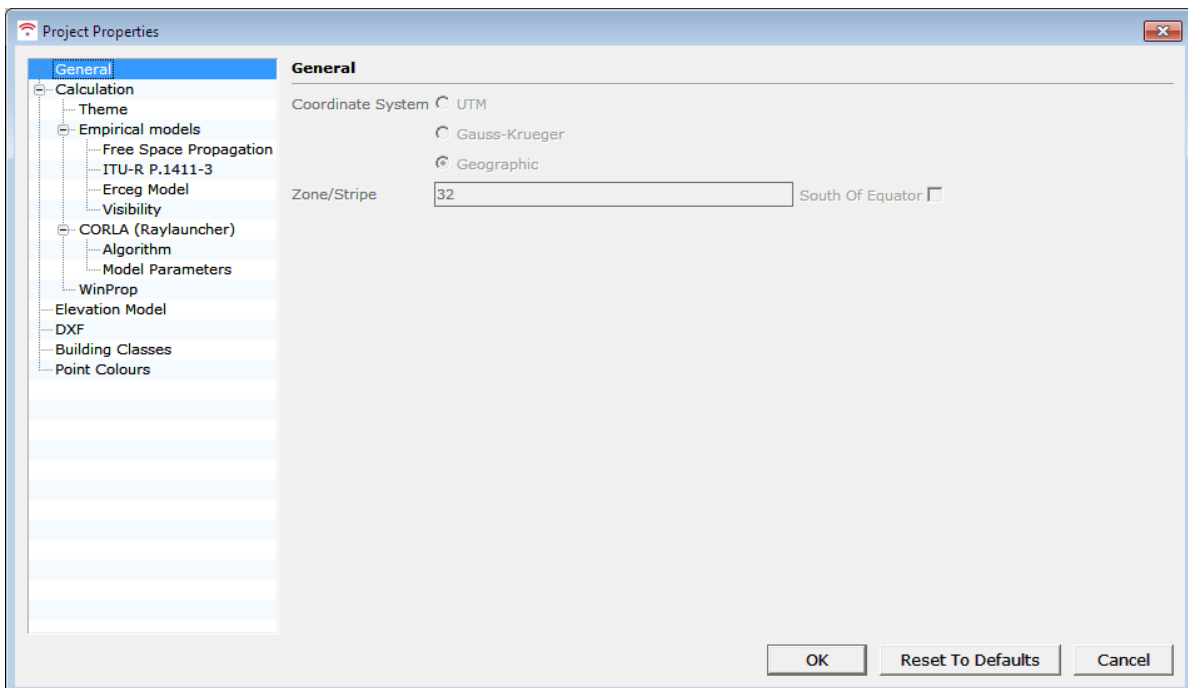


Figure 62: The general settings tab

3.1.2 Calculation

In the **calculation tab** it is possible to choose a default propagation **model**. The default setting is the Erceg Model. These propagation models can also be chosen while calculating. The **Maximum** and **Minimum Antenna Area** can be changed if necessary.



A license file is needed to use CORLA. This license is limited to a project and can be ordered at WIMAP-4G product support.

The elevation theme provides **bilinear interpolation** or **nearest neighbor**. The elevation model can also be chosen during a calculation.

- **Nearest neighbor:** Nearest Neighbor is a weak algorithm. It takes the height of the nearest point which got a value in the elevation model.
- **Bilinear interpolation:** This algorithm is more precise. It considers the closest four neighbors and calculates the average value of their height. That is why it is recommended even if it needs a little bit more processing time (which should not be registered on actual computer systems).



Figure 63: Bilinear interpolation

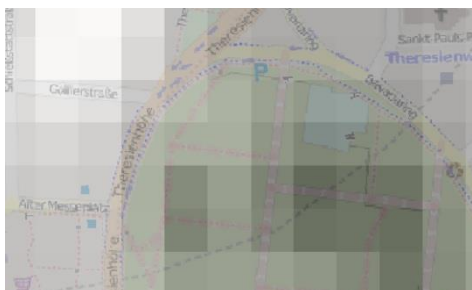


Figure 64: Nearest neighbor

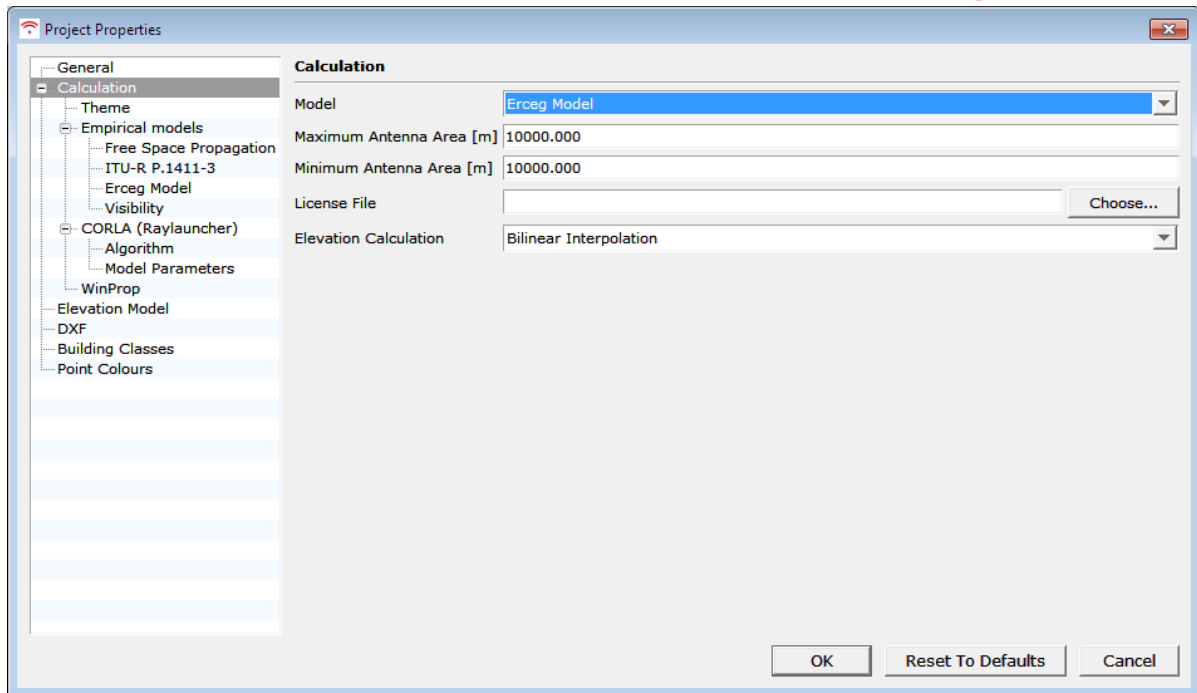


Figure 65: The calculation settings tab

3.1.2.1 Themes

The **themes tab** contains all color settings of the program. Some improvements should be done if larger projects shall be planned. Default settings are preset for every theme. For large projects additional colors should be added as well as some presets for different locations. Theme settings should always be made in **Project Defaults** to keep them saved for future projects.

Color profiles can be changed for

- Best Server
- Field Strength
- Power Level
- Sub Carrier Interference
- Carrier to Interferer (C/I)
- Elevation
- Visibility
- Ec/IO

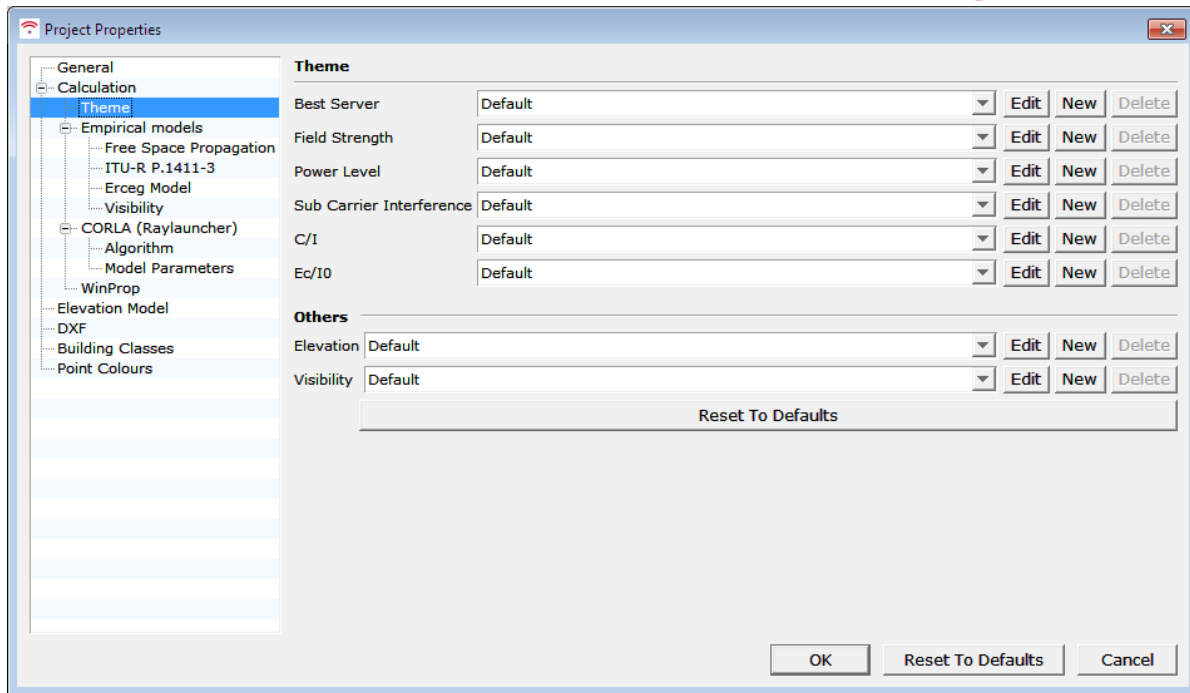


Figure 66: The themes settings tab



3.1.2.1.1 How to Change a Colour Profile

1. Open **Extras->Project Defaults->Calculation->Theme**.

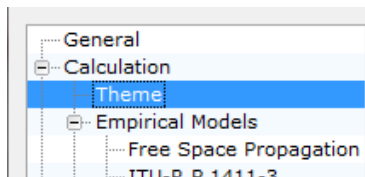


Figure 67: Theme settings tab

2. Select the desired theme, for example **Field Strength**.



Figure 68: Press Edit

3. Press **Edit** to open the configuration window.

Now there are different possibilities to change a colour profile: Renaming Profiles, changing transparency or adding new intervals are possible. **Colour From** and **Colour To** are the colours shown beyond the intervals.

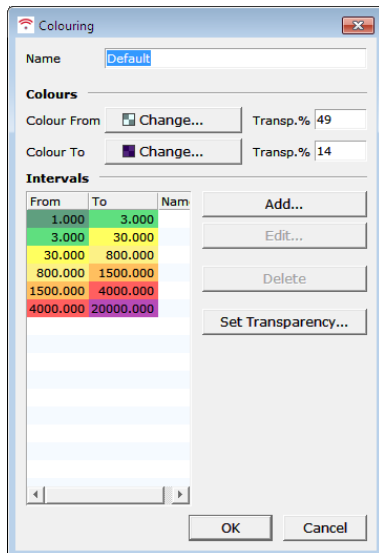


Figure 69: A changed profile

4. Click on **OK** to save the changes.



3.1.2.1.2 How to Add a New Colour Profile

1. Open **Extras->Project Defaults->Calculation->Theme**

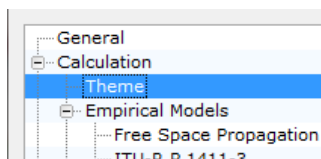


Figure 70: Theme settings tab

2. Select the desired theme, for example **Field Strength**.

3. Press **New** to open the configuration window.



Figure 71: Click on "New"

4. Name the new profile and change colour. (These are the colours shown beyond the intervals.)

5. Add intervals by selecting **Add**.

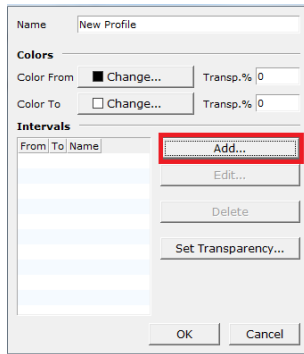


Figure 72: Click Add to add new intervals

6. Fill the required fields (*From, To*).

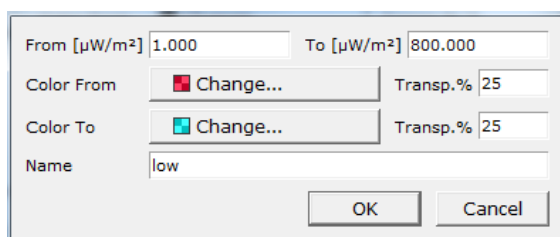


Figure 73: Fill in all fields

7. Choose colours.

8. Name the interval if desired.

9. After adding all desired intervals, press *OK*.

10. Choose a profile for your project.

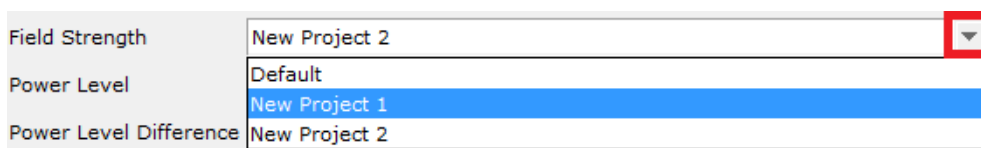


Figure 74: The created profile appears in the list

All settings can be reset at the bottom by clicking **Reset To Defaults**.

3.1.2.2 Empirical Models

Empirical models are used for propagation calculation. The **resolution** is preconfigured or can be configured manually for new projects. The **resolution** can be calculated absolutely (in m) or relatively (in %). A **resolution** can also be chosen during a propagation calculation. The WiMAP-4G Community-Edition only allows an absolute value of 50 m. The

Professional-Edition allows also resolutions up to centimeters. Furthermore, the **attenuation interpolation** can be changed, too.

The standard setting is the **bilinear interpolation**. It should be the proper setting in general.

Other interpolation models should only be chosen if necessary.

- **Bilinear interpolation:** A precise algorithm that considers the closest four neighbors and calculates the average value of their heights.
- **Nearer of both:** Considers the nearest neighbor and carries its value.
- **Maximum of both:** Considers the closest neighbor with the highest value (best case).
- **Minimum of both:** Considers the closest neighbor with the lowest value (worst case).

The **Pathloss Storage Precision** can be changed to one, two and four bytes. One byte should only be chosen if there is a large project to plan and only weak hardware is used. There could be an aberration up to half a dB if **1 Byte** is chosen for pathloss. **4 Byte** is very precise but it could take a long time to calculate large projects. With current hardware **4 Byte** is fine.

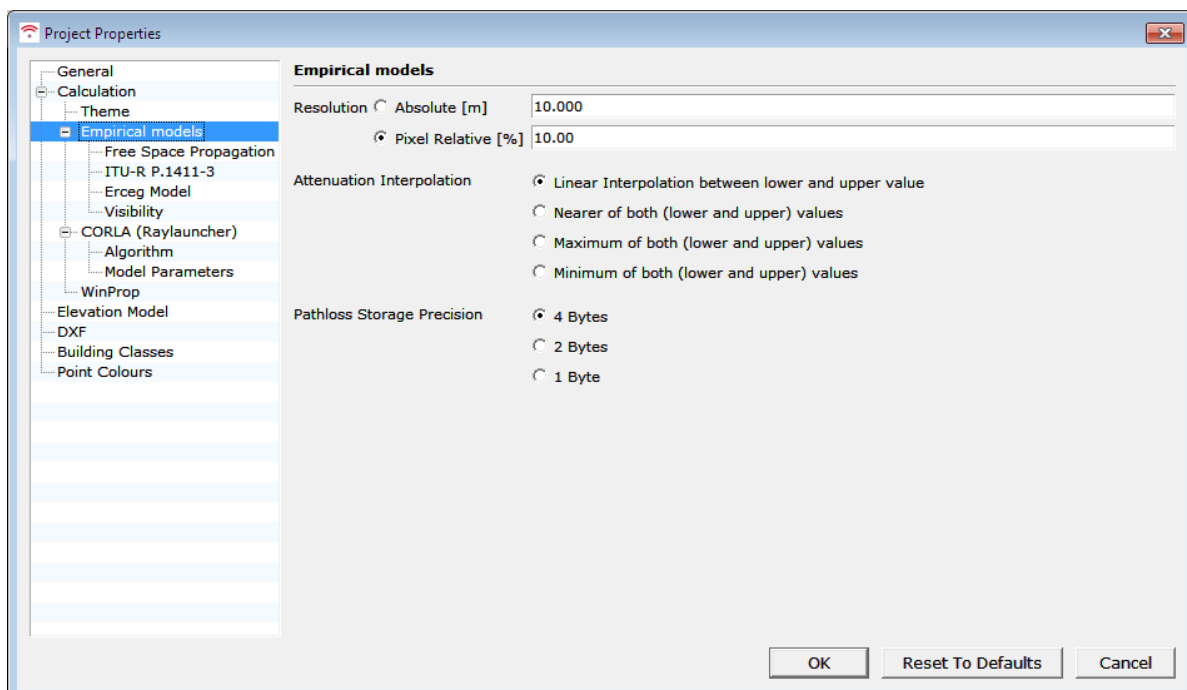


Figure 75: The empirical models settings tab

3.1.2.2.1 Free Space Propagation

The free space propagation is a simple but effective propagation model. It is also called equation of radio wave propagation or Friss Model. The free space propagation model is primarily based on the elevation model. Optionally it takes into account visibility restrictions regarding the elevation model and the building model. While this model is not eligible for city centers and strongly cultured regions, it produces good results for suburban and rural regions, plus it is a very fast algorithm. It can help to identify critical regions where detailed measurements need to be done.

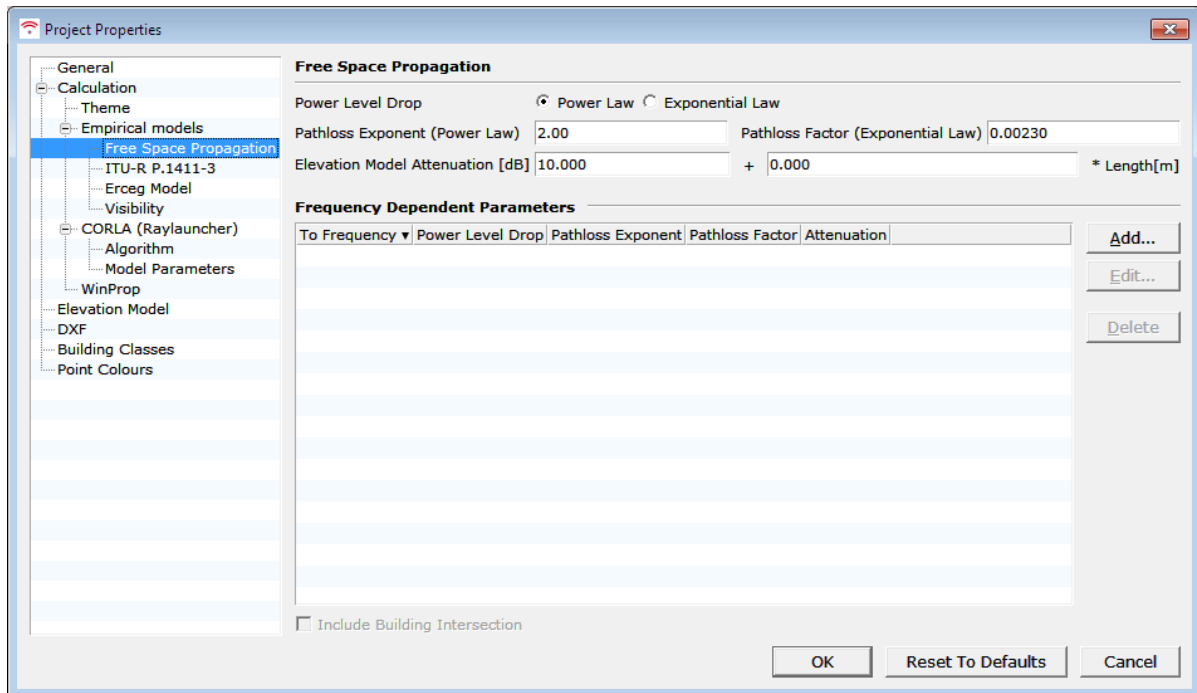


Figure 76: The free space propagation settings tab

There are two possibilities to calculate the path loss:

- Power law (Lee's model)
 - Calculates the path loss with the power law. To use this option a path loss exponent is required. The path loss exponent comes in 1.6 to 6 depending on the terrain conditions.

Table 1: Path loss exponent

Terrain-Type	Path loss exponent
Free Space	2
Plain surface	4
City	2.7 – 3.5
City with shadowing effects	3 – 5
Buildings with line of sight	1.6 – 1.8
Buildings without line of sight	4 - 6

- Exponential law
 - Calculates the path loss with the exponential law. To use this option a path loss factor is required. The standard path loss should only be changed by experienced users.

The **elevation model attenuation** can be set to a specific value to take account of obstacles like buildings and mountains or other line of sight interference. The value depends on the structure and its physical conditions. With the help of **frequency dependent parameters** it is possible to create profiles for every frequency in separate. **Building intersection** can be included in calculations at the bottom. It influences the calculation of a project in city areas and considers the fact that structures could stand in line.



3.1.2.2.1.1 How to Add a New Frequency Dependent Parameter for Free Space Propagation

1. Open **Extras->Project Defaults->Calculation->Empirical Models->Free Space Propagation**

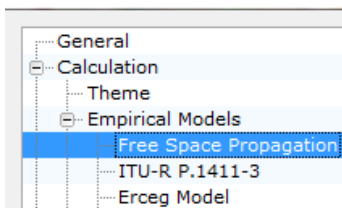


Figure 77: Free space propagation settings tab

2. At the bottom of the window click **Add**.

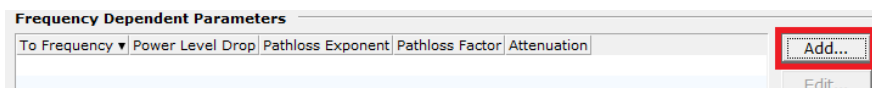


Figure 78: Click Add to add new parameters

3. Choose a **Maximum Frequency** for the profile.

4. Enter a **Pathloss Exponent** and a **Pathloss Factor** and press **OK**. Specific **Pathloss Exponents** can be found at 3.1.2.2.1. The **Pathloss Factor** should be 0.00230 for free space propagation.

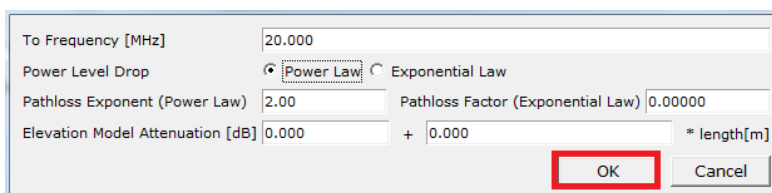


Figure 79: Press OK to save changes

3.1.2.2.2 ITU-R P.1411-3

ITU-R P.1411-3 is a semi-empirical model based on COST 231 Walfish-Ikegami and enhanced by ITU-R. The model considers detailed input data like average height and separation of buildings, street data (width, direction), BS and MS antenna height, length of the path covered by buildings as well as distance from BS to MS.

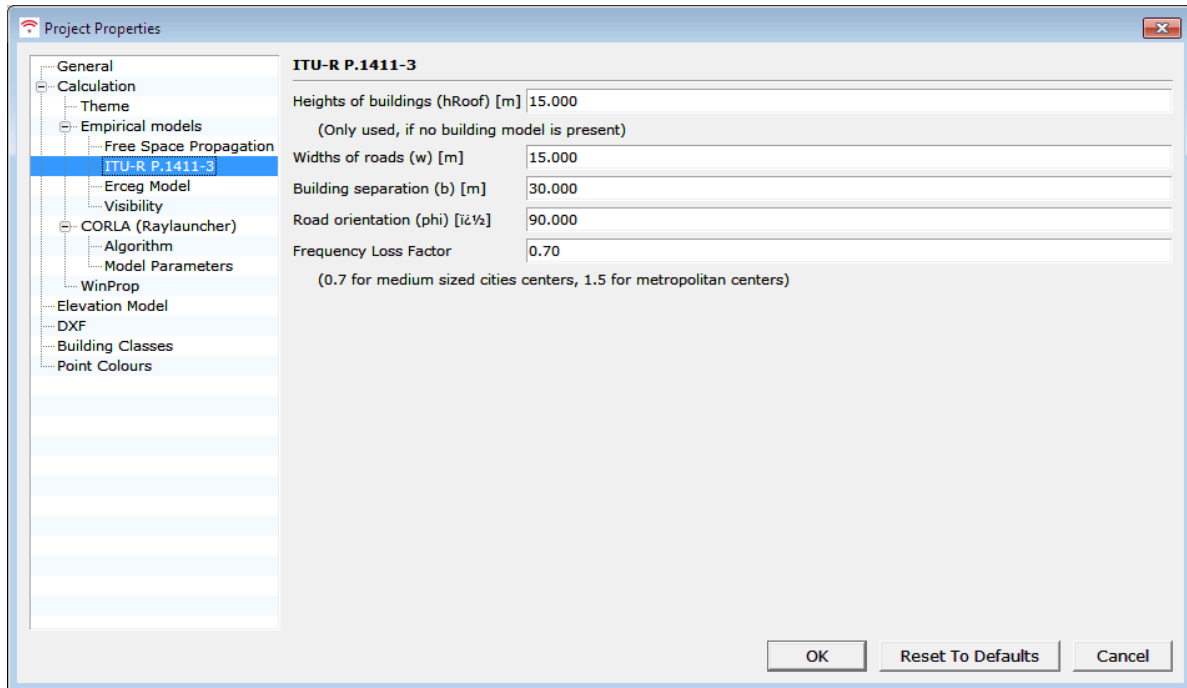


Figure 80: The ITU-R P.1411-3 settings tab

The **ITU-R P.1411-3** settings offer a few settings according to the environment.

- **Maximum height of buildings**
 - This height is only used if there is no elevation model that can be used for calculations. Basically, calculation is more detailed and offers precise results with elevation models.
- **Widths of roads**
 - The width of roads can vary in different cities or villages. It is expressed in meters.
- **Building separation**
 - The Building Separation describes gap distance between Buildings. It is expressed in meters.
- **Road orientation**
 - The road orientation describes the angle between crossing roads. It is expressed in degrees.

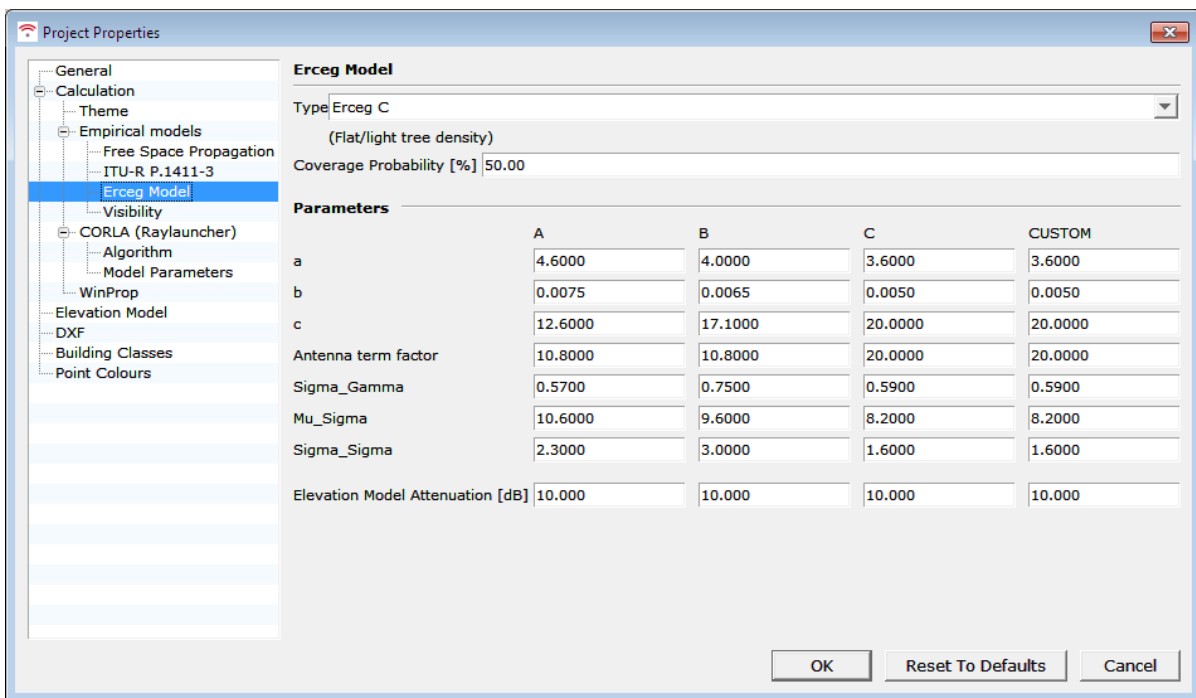
• Frequency Loss Factor

- There is the frequency loss factor that should be either 0.7 or 1.5 according to the environment. 0.7 is used for medium sized city centers whereas 1.5 is used for metropolitan city centers.

3.1.2.2.3 Erceg Model

The IEEE 802.16.3c proposes this model developed by Victor Erceg for WiMAX planning. It is designed for suburban and urban areas and considers three Non-Line-of-Sight (NLoS)-scenarios A, B and C:

- Terrain type **A** is a hilly terrain with moderate to heavy tree density and is associated with the highest path loss.
- Terrain type **B** is characterized as a mostly flat terrain with moderate to heavy tree density or a hilly terrain with light tree density.
- Terrain type **C** is a flat terrain with light tree density, producing the lowest path loss.



Parameters	A	B	C	CUSTOM
a	4.6000	4.0000	3.6000	3.6000
b	0.0075	0.0065	0.0050	0.0050
c	12.6000	17.1000	20.0000	20.0000
Antenna term factor	10.8000	10.8000	20.0000	20.0000
Sigma_Gamma	0.5700	0.7500	0.5900	0.5900
Mu_Sigma	10.6000	9.6000	8.2000	8.2000
Sigma_Sigma	2.3000	3.0000	1.6000	1.6000
Elevation Model Attenuation [dB]	10.000	10.000	10.000	10.000

Figure 81: The Erceg model settings tab

First of all the decision can be made, which Erceg model should be used by default. If there are only a few trees there is no need to use type **A** by default, in that case Type **C** would be the right decision. Furthermore the coverage probability can be set to a specific value. This probability identifies the chance that gives the customer a specified link quality.

At the bottom all the parameters can be changed for each Erceg model. Changing the parameters from Erceg **A**, **B** and **C** should only be done by experienced users. All other users could get some experience in changing the custom model.

These three parameters for the path loss exponent, which is variable over the population of macro cells within each terrain category, should only be changed for extreme terrain conditions.

Antenna-Term Factor:

Sigma-Gamma:

Sigma-Mu:

Sigma-Sigma:



Data derived constant for each terrain type

Only experienced users should change these.

3.1.2.2.4 Visibility

Some visibility settings can be changed according to the elevation theme and building intersection. First of all it is possible to change the **elevation model visibility** type. The types, **bilinear stepwise** or **bilinear cellwise**, can be chosen.

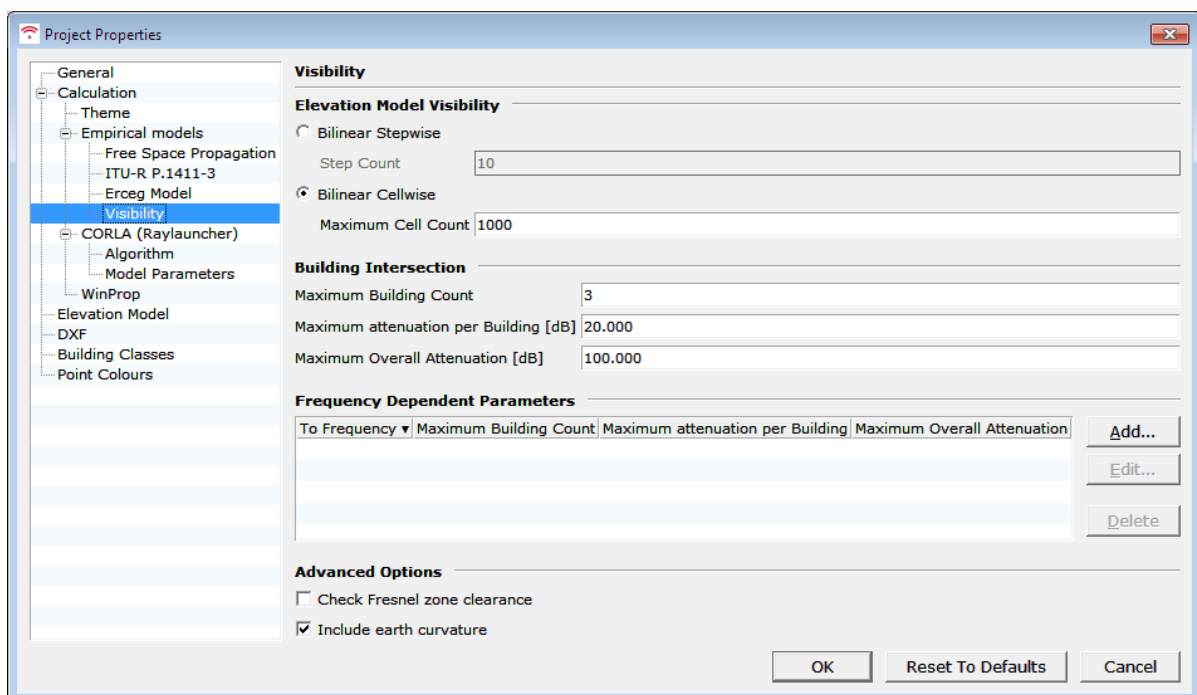


Figure 82: The visibility settings tab

The next settings concentrate on the **building intersection**. These settings would be important if the project was planned in areas with a lot of buildings like city centers. First thing to decide is the **maximum building count** for the building intersection. This parameter depends on the **maximum attenuation per building** and the **maximum overall attenuation**. The maximum building count multiplied with the maximum

attenuation per building should not be higher than the maximum overall attenuation. This feature should only be used if the maximum attenuation per building is known. For the advanced user it is also possible to add **frequency dependent parameters**. If the attenuation is well-known, frequency dependent parameters can help a lot in getting results close to reality.



3.1.2.2.4.1 How to Add a New Frequency Dependent Parameter for Building Intersection

1. Open **Extras->Project Defaults->Calculation->Empirical Models->Visibility**

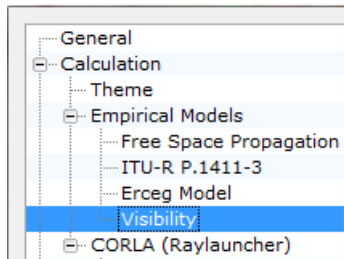


Figure 83: The visibility settings tab

2. At the bottom part of the window in the frequency dependent parameters window, click on **Add**.

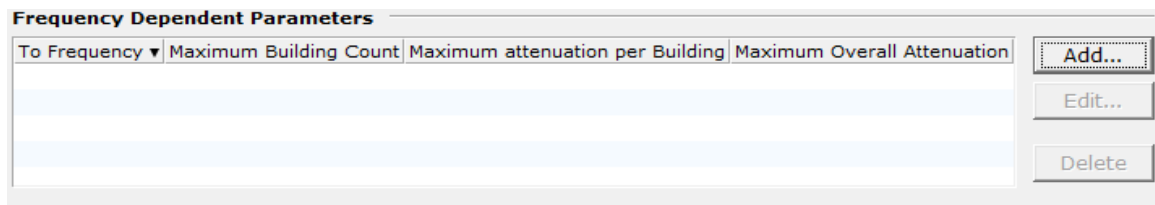


Figure 84: Click Add to add new parameters

3. A new window opens and some values need to be added.

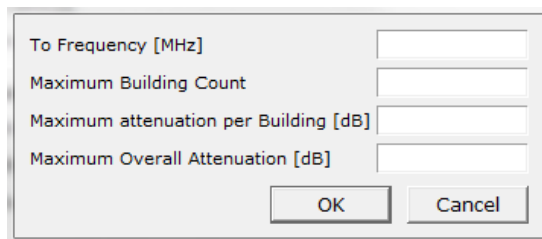


Figure 85: Fill in all fields

- **To Frequency:** The maximum frequency for attenuation (for example 2.4 GHz)
- **Maximum Building Count:** The maximum count of intersecting buildings
- **Maximum Attenuation per Building:** The maximum attenuation one building can achieve
- **Maximum Overall Attenuation:** The maximum attenuation that can be reached if a lot of buildings intersect

To Frequency [MHz]	2400.000
Maximum Building Count	5
Maximum attenuation per Building [dB]	20.000
Maximum Overall Attenuation [dB]	100.000
OK Cancel	

Figure 86: Click OK to save the changes

4. Click on **OK** to add the new frequency dependent parameter.

The new parameter is created and will be used in the project.

To Frequency	Maximum Building Count	Maximum attenuation per Building	Maximum Overall Attenuation	
2400.000	5	20.00	100.00	Add... Edit... Delete

Figure 87: The created parameter appears in the list

3.1.2.3 CORLA (Raylauncher)

CORLA (Cube Oriented Ray Launching Algorithm) is a powerful propagation model based on the 3D raylaunching technology. CORLA provides a cube based representation of the area which leads to fast identification, processing of diffraction and reflection sources. Different antenna patterns, delay spread and building penetration are inherent features of the algorithm. Hence CORLA is optimized for speed, it is 20 to 40 times faster than other ray launching solutions and therefore qualified to be used in WiMAP-4G. Due to the complexity of the CORLA Raylauncher, there are many adjustments to be done to optimize it for a better use in the current project.

Project Properties	
- General - Calculation - Theme - Empirical models - Free Space Propagation - ITU-R P.1411-3 - Erceg Model - Visibility CORLA (Raylauncher) - Algorithm - Model Parameters - WinProp - Elevation Model - DXF - Building Classes - Point Colours	CORLA (Raylauncher) Executable Path: C:\Program Files\WiMAP-4G\demo\CorlaDemo.exe Choose... Resolution X/Y [m]: 3.000 Resolution Z [m]: 3.000 Maximum Memory Limit [MB]: 512.00 ☒ Resample Elevation Model To Cube X/Y-Size ☒ Calculate In Buildings Pattern In case of ambiguous antenna pattern: ☒ Create pattern leading to maximum power level ☐ Create pattern leading to minimum power level OK Reset To Defaults Cancel

Figure 88: The CORLA settings tab

First of all the **executable path** to the **CORLA.exe** needs to be set. This always needs to be done prior to making a calculation with the CORLA raylaunching algorithm.



The CORLA Raylauncher requires an extra license. It can be ordered at the WiMAP-4G product support. Contact info@brown-iposs.eu for more information.

The next two options deal with the resolution used while calculating something with the CORLA Raylauncher:

- **Resample Elevation Model To Cube X/Y Size:** Activating this option forces the CORLA algorithm to load and resample the elevation model. This is important for small areas since CORLA needs a specific minimal resolution of the elevation model to be able to calculate. If this resolution cannot be provided of the elevation model used in the project, activate this option.
- **Calculate in Buildings:** Choose whether to calculate inside buildings or not. At the bottom of the window antenna pattern options can be found. As already mentioned, CORLA holds antenna patterns, which can be used in case ambiguous antenna patterns are used in the current project. Choose between **Create pattern leading to maximum power level** or **Create pattern leading to minimum power level**.

3.1.2.3.1 Algorithm

The algorithm tab offers a few possibilities to adjust the accuracy of the CORLA Raylauncher.

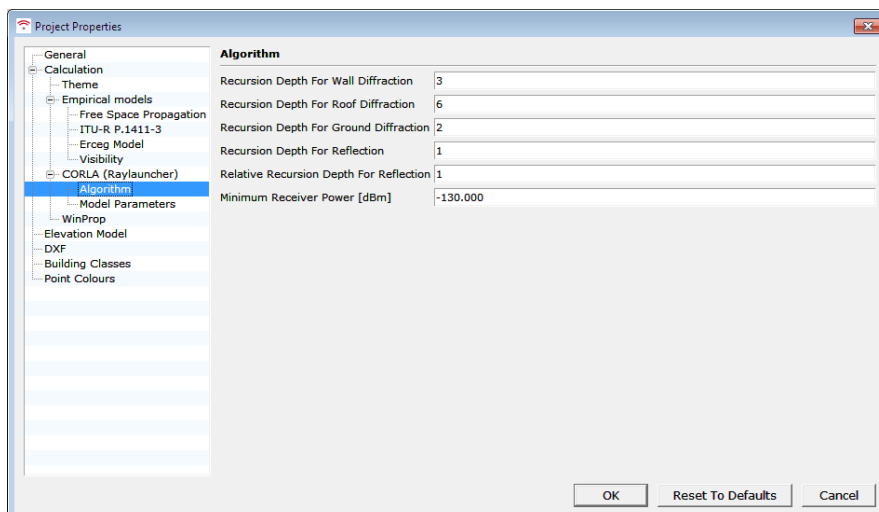


Figure 89: The CORLA algorithm tab

The parameters are mostly self-explanatory:

- **Recursion Depth For Wall Diffraction:** The number of walls which could diffract the signal.
- **Recursion Depth For Roof Diffraction:** The number of roofs which could diffract the signal.
- **Recursion Depth For Ground Diffraction:** Maximal number of signal diffraction by the ground.
- **Recursion Depth For Reflection:** Maximal number of signal reflection by anything.
- **Relative Recursion Depth For Reflection:** Relative number of signal reflection by anything.
- **Minimum Receiver Power:** Minimal receiver power that can be transformed into a usable signal.

Editing these parameters should only be done by experienced users who are familiar with the CORLA algorithm and can assess the consequences of changing these parameters. The default parameters offer a good quality and also a fast calculation. Choosing higher numbers for reflections or diffractions can extend the calculation time for many hours or even days.

3.1.2.3.2 Model Parameters

The model parameters offer full access to the algorithm parameters. Hence this algorithm is very complicated, the model parameters should only be changed by experienced users.

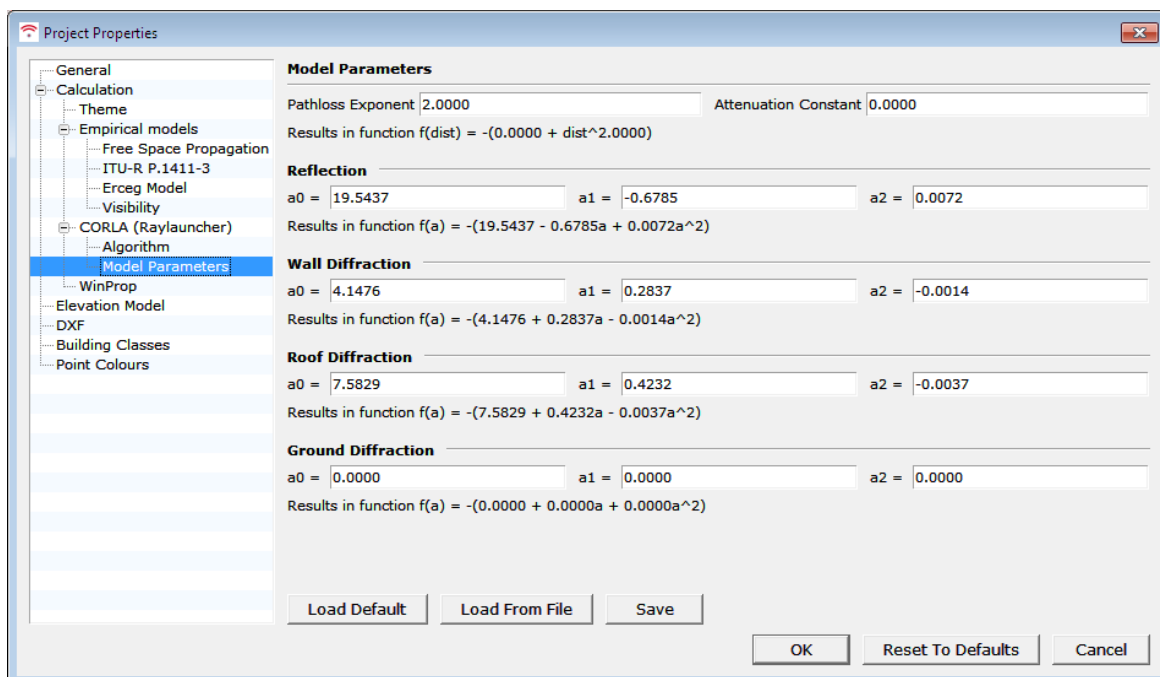


Figure 90: The CORLA model parameters tab

At the bottom of the window, it is possible to import a model parameter file in the actual project. This enables the user to share configuration files between projects. The actual configuration can also be saved by clicking on **Save**. Furthermore it is possible to set the configuration to the default parameters by clicking on **Load Default**.



Do not change Corla parameters if you are not 100 % sure what you are doing. Since the CORLA Raylauncher is not developed by brown-iposs, further information can only be gathered from TNC. The WiMAP-4G product support will open the contact on request.

3.1.2.4 WinProp

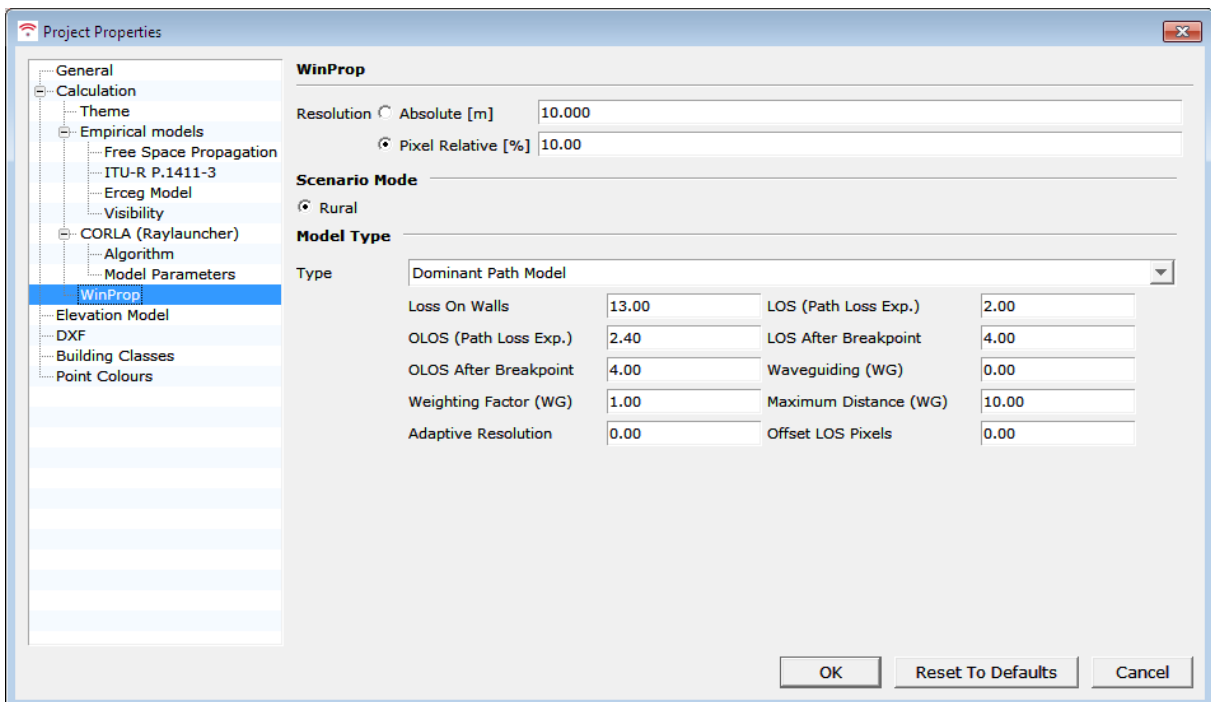
WinProp is for propagation modeling in different scenarios (like Rural, Indoor and Outdoor) with different model types of calculation. In this version, only insert Rural. There are four model types include:

The **Dominant Path Model** calculates the path loss on the main paths between transmitter and each receiver pixel by high precision like the ray tracing.

The **Okumura-Hata Model** calculates the path loss based on four factor, *frequency* (between 150MHz – 1500MHz), *distance* (1km – 20km between transmitter and receiver), *height of transmitter* (between 30m – 200m), and *height of receiver* (between 1m – 10m).

The **Empirical Two Ray Model** calculates the path loss by each pixel on the map, without looking for the point is hidden or unreachable.

The **Deterministic Two Ray Model** calculates the path loss by each pixel on the map with checking whether the point is not hidden and reachable.



The screenshot shows the 'Project Properties' dialog box with the 'WinProp' tab selected. The left sidebar lists various configuration categories, with 'WinProp' highlighted. The main area contains the following settings:

- Resolution:** ☐ Absolute [m] (10.000), ☒ Pixel Relative [%] (10.00)
- Scenario Mode:** ☒ Rural
- Model Type:** Dominant Path Model (selected from a dropdown)
- Parameters:**

Loss On Walls	13.00	LOS (Path Loss Exp.)	2.00
OLOS (Path Loss Exp.)	2.40	LOS After Breakpoint	4.00
OLOS After Breakpoint	4.00	Waveguiding (WG)	0.00
Weighting Factor (WG)	1.00	Maximum Distance (WG)	10.00
Adaptive Resolution	0.00	Offset LOS Pixels	0.00

Buttons at the bottom: OK, Reset To Defaults, Cancel.

Figure 91: The WinProp Properties

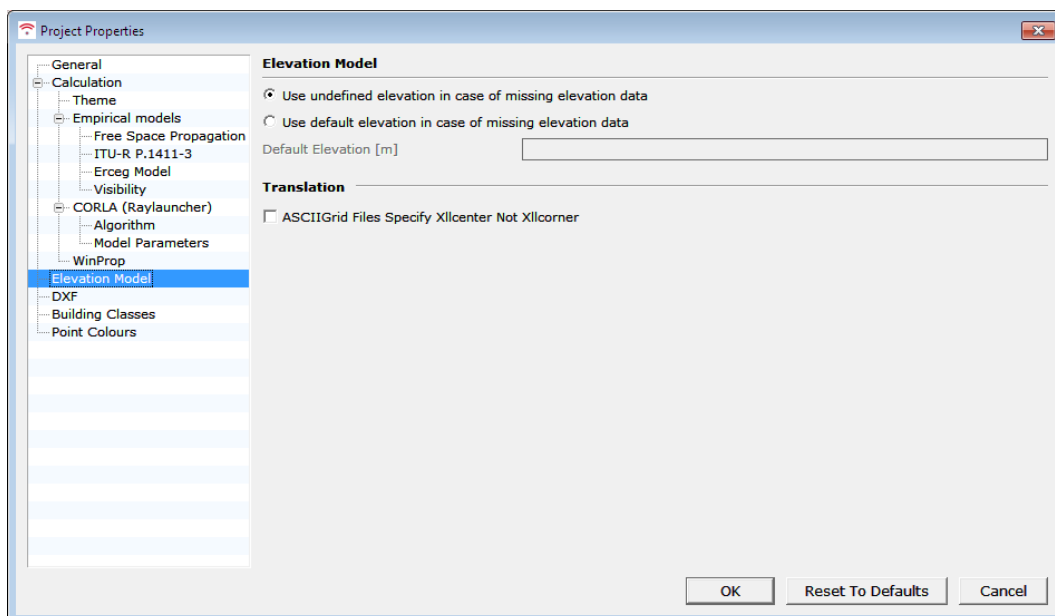

OLOS: =NLOS = non-light-of-sight connection

LOS: light-of-sight connection

WG: Waveguiding

3.1.3 Elevation Model

In the elevation model settings the standard environment elevation can be changed in case of there is no elevation model data available for the project. Elevation can be changed by activating **Use default elevation in case of missing elevation data** and specifying a value. Furthermore, it can be decided if ASCII grid files should be specified on xllcenter or xllcorner.


Figure 92: The elevation model settings

3.1.4 DXF

There is no need for explaining .DXF settings here. It gets important while importing cadastral data. For .DXF settings see 4.1.2.

3.1.5 Building Classes

The **building classes** submenu allows the user to create new buildings or wood profiles. This is important while creating buildings or wood. For example one class of buildings cannot overlap itself, so if the user wants to create nested buildings he needs to create more than one class of buildings. It is the same for wood.

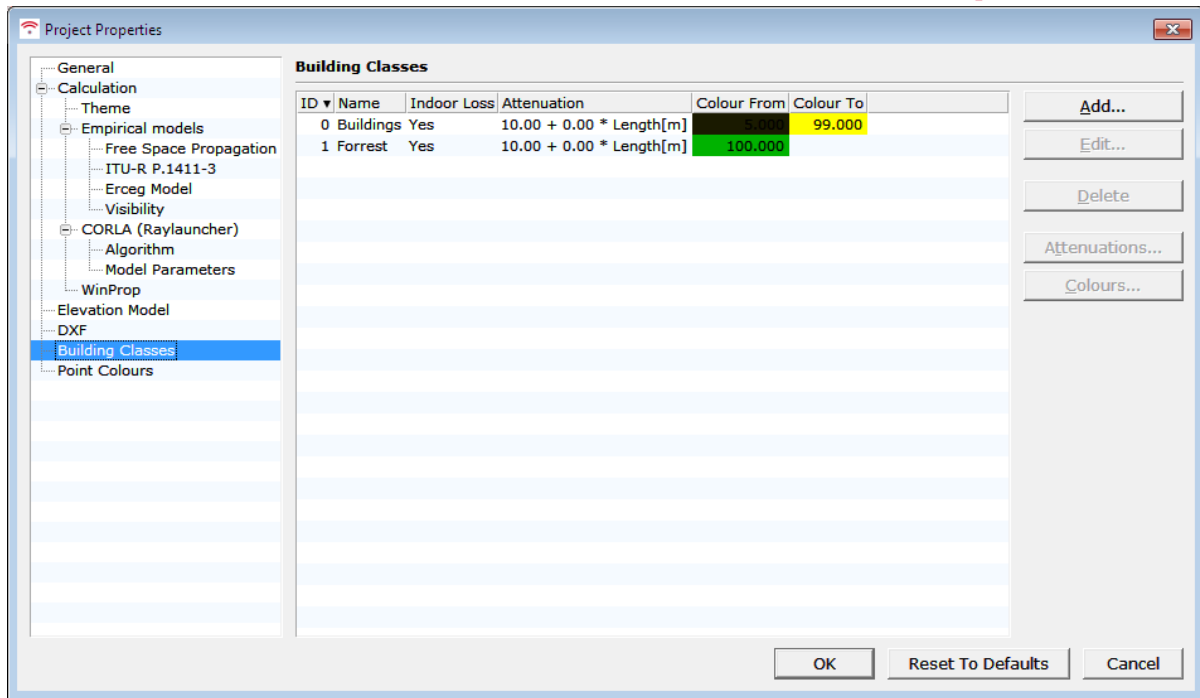


Figure 93: The building classes settings



3.1.5.1 How to Add a Building or Wood Profile

1. Open **Extras**→**Project Defaults**→**Building Classes**.

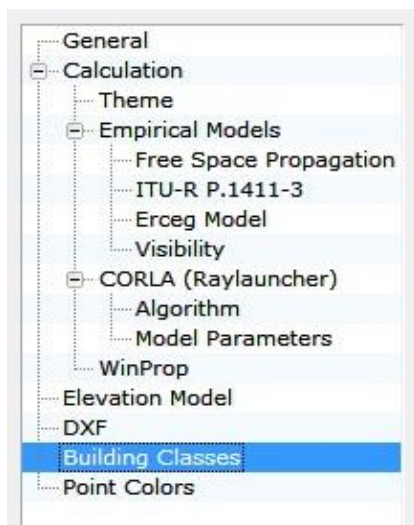


Figure 94: The building classes settings

2. Click on **Add**.

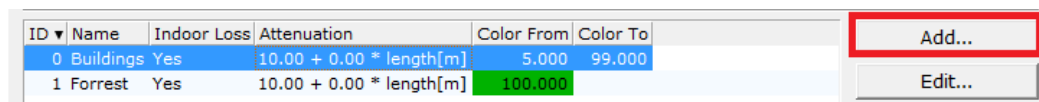


Figure 95: Click Add to add a new building class

3. Type in next **ID** and **Name** and click on **OK**. Indoor loss should be applied except when there are no walls or doors etc.

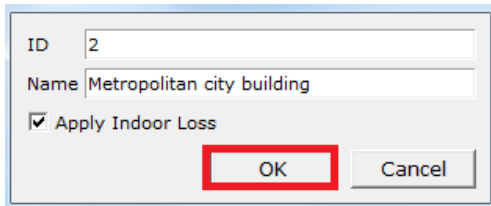


Figure 96: Click OK to save the changes

4. Select the new building from the list and click on **Attenuation** and then on **Add**.

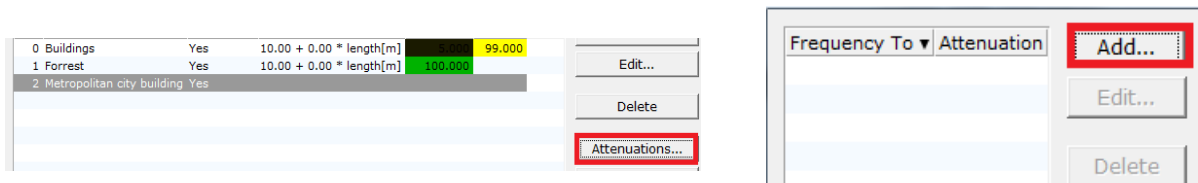


Figure 97: Add new attenuation parameters

5. Add new **Frequency** and **Attenuation**. The second field should only be filled if there are some special circumstances inside the building. **Double-click on OK**.



Figure 98: Save the changes with OK

6. Click on **Color** and **Add**.

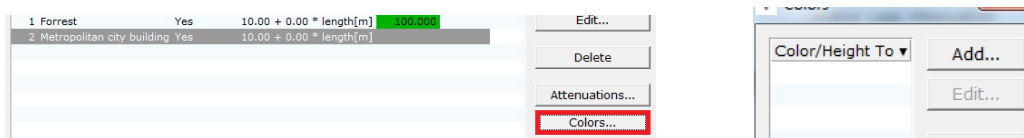


Figure 99: Colours need to be added

7. Gradually insert building heights and the related desired colors. After this is done, **double-click on OK**.

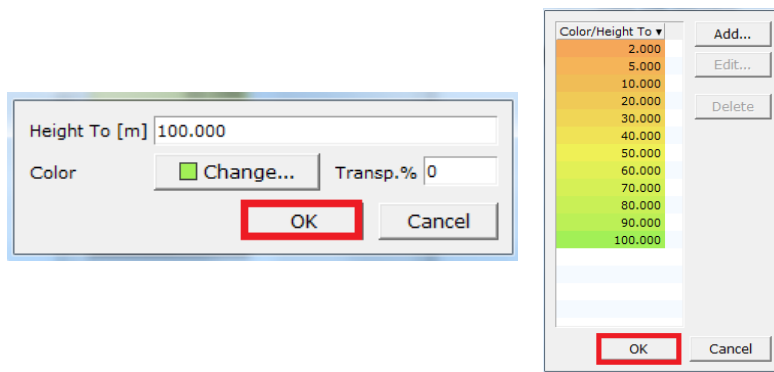


Figure 100: Click OK to save all changes

This works for wood, too.

3.2 Create Projects

After configuring the project settings, it is time to create a real project.

A new project can be created:

- during the start of WiMAP-4G

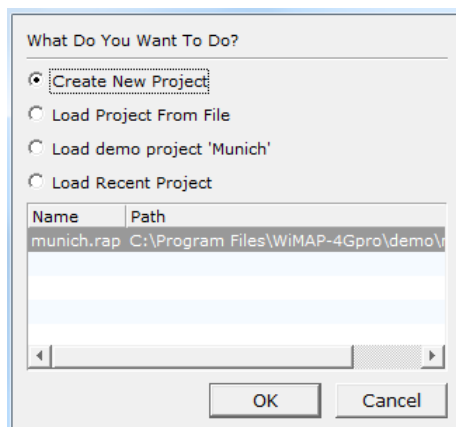


Figure 101: The start dialog

- by choosing **Project** → **New** while WiMAP-4G is running. Current projects can be saved or discarded.

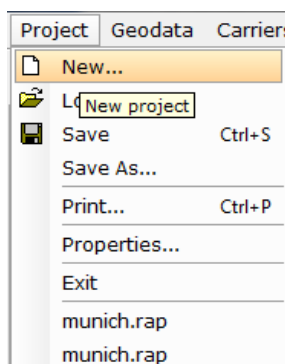
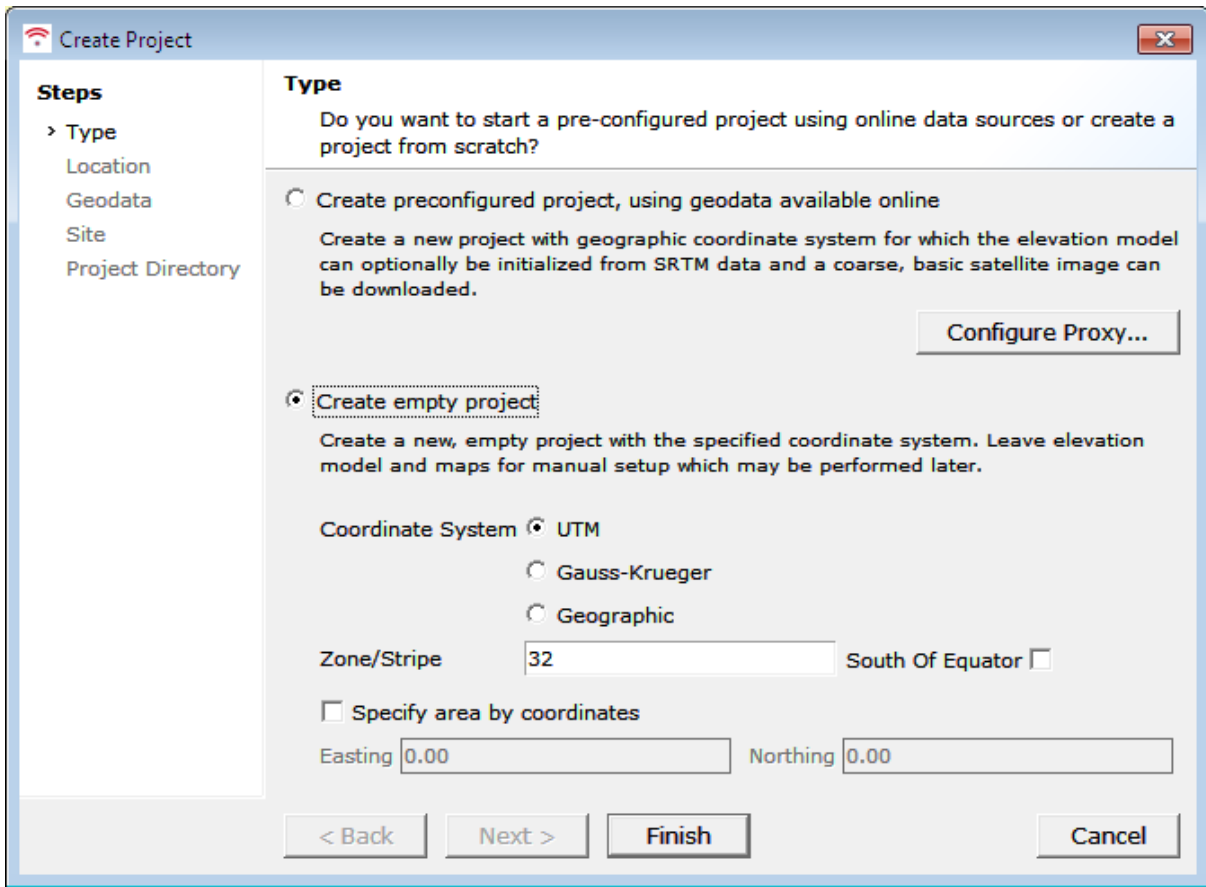


Figure 102: Create a new project

The **Create Project Dialog** appears.



The screenshot shows the 'Create Project' dialog box. On the left, a 'Steps' sidebar lists 'Type', 'Location', 'Geodata', 'Site', and 'Project Directory', with 'Type' currently selected. The main area is titled 'Type' and contains the question: 'Do you want to start a pre-configured project using online data sources or create a project from scratch?'. There are two radio button options: 'Create preconfigured project, using geodata available online' (unselected) and 'Create empty project' (selected). The 'Create empty project' option has a description: 'Create a new, empty project with the specified coordinate system. Leave elevation model and maps for manual setup which may be performed later.' Below this, there are settings for the 'Coordinate System' (radio buttons for UTM, Gauss-Krueger, and Geographic, with UTM selected), a 'Zone/Stripe' text box containing '32', and a 'South Of Equator' checkbox (unchecked). There is also a 'Specify area by coordinates' checkbox (unchecked). Below this, there are 'Easting' and 'Northing' text boxes, both containing '0.00'. At the bottom, there are four buttons: '< Back', 'Next >', 'Finish', and 'Cancel'. A 'Configure Proxy...' button is also present next to the first radio button option.

Figure 103: The project-creation dialog

There are two ways to create a new project:

- Create a preconfigured project with elevation model.
- Create an empty project.

3.2.1 Create Preconfigured Projects

This option creates a new project with a geographic coordinate system. An elevation model can optionally be initialized from SRTM data and a basic satellite image can be downloaded. This is the easiest way to create a project because the elevation model can be initialized during creation.



Creating a preconfigured project requires internet connection. If a proxy is in use, optional proxy settings should be done by clicking "Configure Proxy..."



3.2.1.1 How to Create a Preconfigured Project

1. Open **Project→New** or choose  from the Control Bar.

2. Choose **Create preconfigured project, using geodata available online** and click on **Next**. If a proxy server is in use, configure WiMAP-4G by clicking on **Configure Proxy**.

Steps	Type
> Type	Do you want to start a pre-configured project using online data sources or create a project from scratch?
Location	
Geodata	☒ Create preconfigured project, using geodata available online Create a new project with geographic coordinate system for which the elevation model can optionally be initialized from SRTM data and a coarse, basic satellite image can be downloaded.
Site	
Project directory	
	Configure Proxy...

Figure 104: Choose this type and click Next

3. Specify the area **by address** or **by coordinates**.

These are the two possibilities to specify an area for the geodata download. Specifying an area **by address** is the easiest method which allows the user to enter a name of a place or a zip-code or to choose an area from the result list. To specify an area **by coordinates** the correct longitude and latitude is required.



If coordinates are unknown they can be found easily by using <http://maps.bing.com> or Google Earth. Look at 3.2.1.1.1 for more information.

3.1 Specify area by address

Insert name of a place or zip code and click on **Search**.

Location

Select the location/area of your project either by address or directly by coordinates.

☒ Specify area by address

Address

Address	Longitude	Latitude

Figure 105: Click search

*Choose from the result list and click on **Next**.*

☒ Specify area by address

Address

Address	Longitude	Latitude
55, 53229, Köln, Nordrhein-Westfalen, Deutschland	7°10'22.746	50°45'05.713
57, 53229, Köln, Nordrhein-Westfalen, Deutschland	7°10'22.839	50°45'05.927
59, 53229, Köln, Nordrhein-Westfalen, Deutschland	7°10'22.933	50°45'06.142
61, 53229, Köln, Nordrhein-Westfalen, Deutschland	7°10'23.026	50°45'06.356
63, 53229, Köln, Nordrhein-Westfalen, Deutschland	7°10'23.120	50°45'06.570
65, 53229, Köln, Nordrhein-Westfalen, Deutschland	7°10'23.214	50°45'06.785
41, 53229, Köln, Nordrhein-Westfalen, Deutschland	7°10'24.430	50°45'05.578
43, 53229, Köln, Nordrhein-Westfalen, Deutschland	7°10'24.390	50°45'05.760
45, 53229, Köln, Nordrhein-Westfalen, Deutschland	7°10'24.349	50°45'05.941

Figure 106: Choose a result from the list

3.2 Specify area by coordinates

*Insert longitude and latitude into the corresponding fields and click on **Next**.*

☒ Specify area by coordinates

Longitude Latitude

Figure 107: Enter coordinates and click Next

4. Here it is possible to download the geodata from the internet. Missing SRTM (**Shuttle Radar Topography Mission**) values can also be selected, which induces the program to interpolate the missing areas.



The Shuttle Radar Topography Mission (SRTM) is a NASA mission conducted in 2000 to obtain elevation data for most of the world. It is the current dataset of choice for digital elevation model data (DEM) since it has a fairly high resolution (about 90 meters at the equator, and <30 meters in the U.S.), has near-global coverage (from 56° S to 60° N), and is released into the public domain.

Furthermore a satellite image can be downloaded from OnEarth. The last setting is the radius in meters. It specifies the maximum area which propagation models can be calculated in.

If all settings are done, *click on **Next**.*

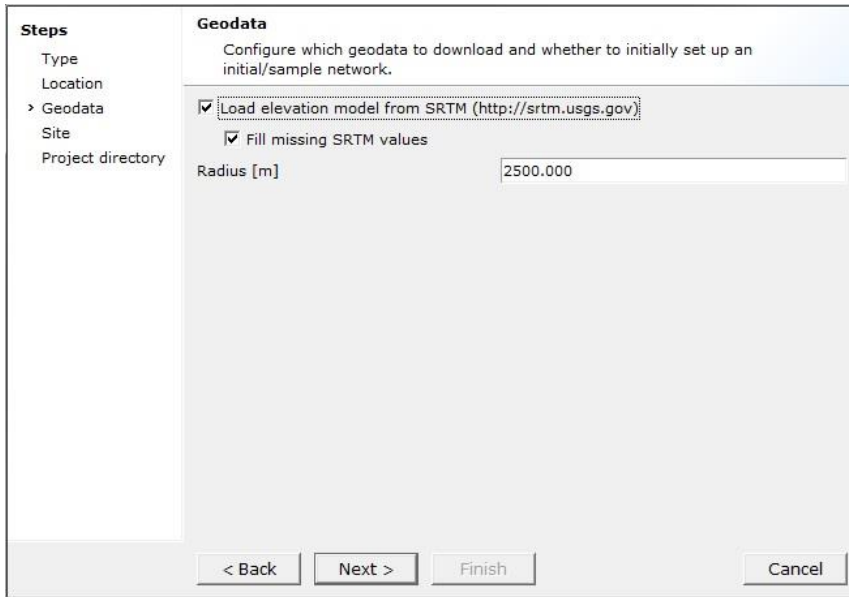


Figure 108: Choose the radius of the area



Changing the maximum size of an area at a later date is possible by deleting elevation and loading it newly from Web. However a bigger area is always a good choice even if the download takes a little bit longer to avoid the need for later modification.

5. Choose if an example site should appear on the map or not. If yes, choose whether it should be a site with three sector antennas or one omni antenna and decide on one of the technologies.

Click on **Next**.

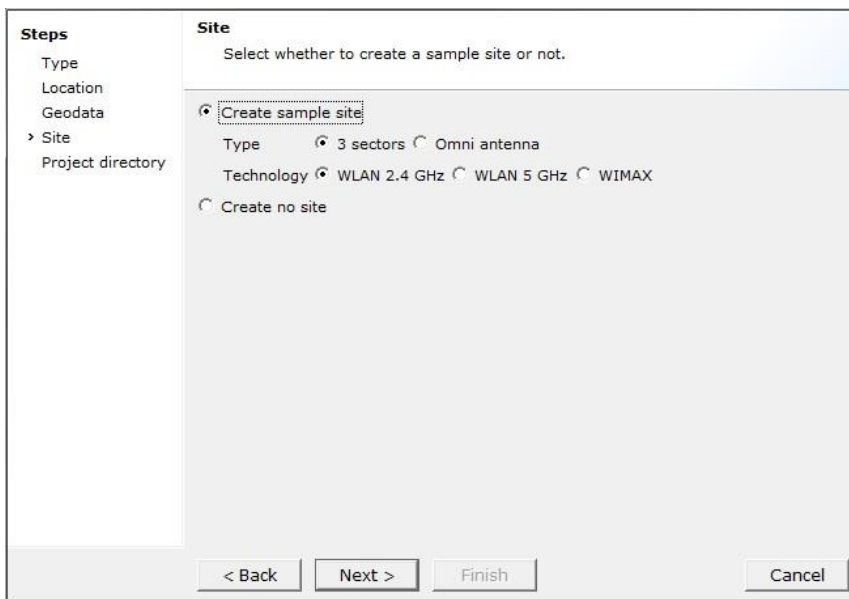


Figure 109: Choose an example site

6. Choose a project folder. A folder for a new project must be an empty folder. *New folders can be created by right-clicking on the desired location and clicking on **Create**. Select this new Folder and press **Finish**.* Now the project has been created successfully and the user can start working.



3.2.1.1.1 How to Find Specific Geographic Coordinates with Google Maps

1. Open <http://maps.google.com> and search for the specific area.

Example: Bonn, Germany

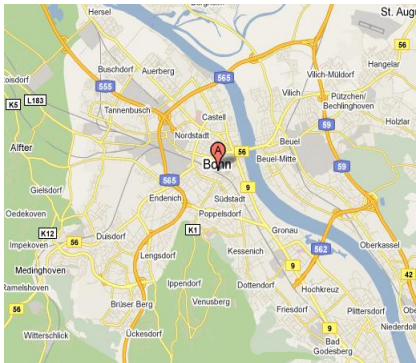


Figure 110: Result returned from Google maps

2. Right click on the red marker and select **What's here?**



Figure 111: Right-Click the red marker

3. Now the specific coordinates appear in the search bar wherein 50.639062 is the latitude and 7.094765 is the longitude.

50.739062,7.094765

Figure 112: The coordinates

4. Copy longitude and latitude to WiMAP-4G (please make sure that project coordinates are set to Geographic Coordinates).

3.2.2 Create Empty Projects

This option creates a new empty project. The coordinate system type can be specified, elevation model and satellite images can be imported later.



An empty project does not need to be saved while creation.

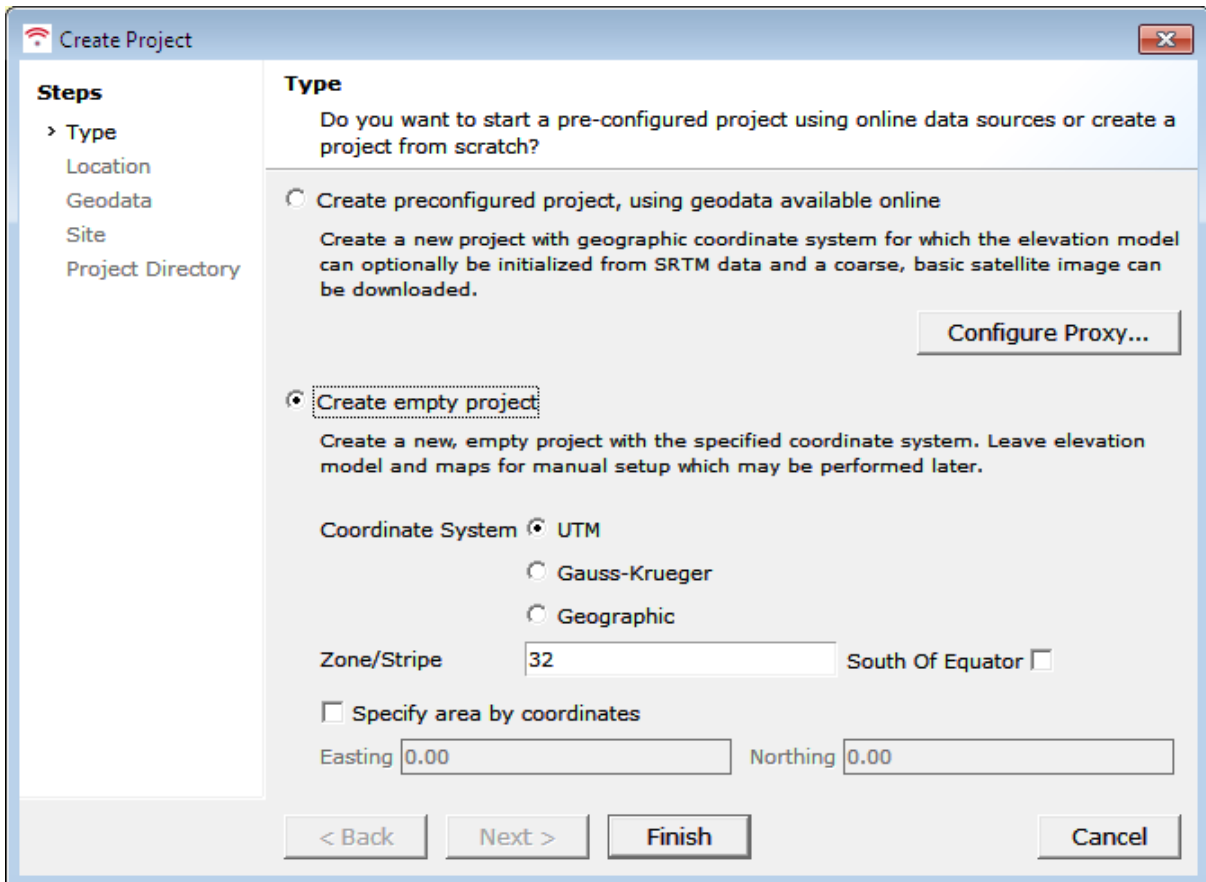


3.2.2.1 How to Create an Empty Project

1. Open **Project→New** or choose  from the Control Bar.

2. Choose **Create empty project**.

3. Choose a coordinate system (**UTM, Gauss-Krueger, Geographic**).



Create Project

Steps

- > Type
- Location
- Geodata
- Site
- Project Directory

Type

Do you want to start a pre-configured project using online data sources or create a project from scratch?

☐ Create preconfigured project, using geodata available online

Create a new project with geographic coordinate system for which the elevation model can optionally be initialized from SRTM data and a coarse, basic satellite image can be downloaded.

☒ **Create empty project**

Create a new, empty project with the specified coordinate system. Leave elevation model and maps for manual setup which may be performed later.

Coordinate System ☒ UTM

☐ Gauss-Krueger

☐ Geographic

Zone/Stripe South Of Equator ☐

☐ Specify area by coordinates

Easting Northing

Figure 113: Choose a coordinate system type



UTM: The "Universal Transverse Mercator" System is a coordinate system that makes it possible to locate every point on earth with the help of two length declaration. Therefore it splits the earth in 6° wide zones. The X-value represents the distance between a point and the meridian of origin while the Y-value represents the distance between a point and the equator. Both values are specified in meter. The Universal Transverse Mercator coordinate System more and more displaces the Gauss-Krueger system.

Gauss-Krueger: The Gauss-Krueger system is based on the same technique as UTM but splits the earth in 3° wide Zones instead of 6° like UTM.

Geographic: The geographic coordinate system is the standard system used by OpenStreetMap and Google. Every point on earth can be specified by an X- and Y-coordinate which are specified in degree. The X-coordinate can have a value between -180° and 180° while the Y-value can be everything between -90° and 90°. A location can be specified more precisely by using angular minutes and seconds (angular seconds are decimal numbers, too).
0.001 angular second = 0.5 m.

4. If **UTM** is chosen, *decide on a zone/stripe, if this zone/stripe in the south of the equator, select this option and insert coordinates of specify area* . The default zone 32 is the zone Germany is located in.

If **Gauss-Krueger** is chosen, select the option south of the equator if the area there and optional insert coordinates of specify area.

If **Geographic** is chosen, it is sufficient to insert coordinates of the specified area only.

5. Click on **Finish**.

An empty project is created and imports can be done later. For more information see the following chapters.

3.3 Load Projects

Projects can be loaded by *choosing **Project→Load** or clicking  on the Control-Bar*. The **File Explorer** will open and a project file (.rap) can be chosen. If there is an active project, it is possible to save or discard it, before loading a new project. Recent projects are shown on the project submenu at the bottom.

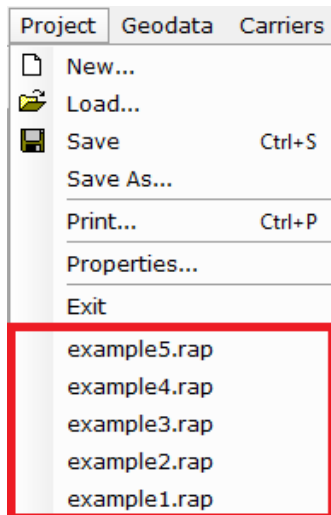


Figure 114: The easy way to load projects

3.4 Save Projects

Projects can be saved *by choosing **Project→Save** or clicking  on the Control-Bar. **Save as** can also be chosen from the Project submenu. With **Save as**, a project can be renamed or saved at another location.*



Projects can also be saved with the Shortcut STRG+S.

4 Geodata

Importing geo-data is one of the most important things to bear in mind while working on a project. Geo-data makes sure that the user takes account of elevation, buildings, wood and other environmental factors. Cadastral data, elevation models and background images can be imported in WiMAP-4G.



A professional project should never be planned without geo-data import because it affects the results in a certain extent.

4.1 Cadastral Data

Cadastral data is a comprehensive register of the land parcels of a country or parts of a country. It includes the precise location, dimension and the cultivation of an individual parcel. Cadastral data can be purchased at the local land survey register. For presentations, it can be useful to see the exact data signal power for a customer. The destination of a site can be planned better if the user knows what is out there. Cadastral data is not as important as a good elevation model, but it can help the user to get an idea of the environment and take account of some special circumstances which may exist. Import cadastral data in .dxf, meaning "direct interchange Format".



4.1.1 How to Import Cadastral Data

1. Open **Geodata** and choose **Load Cadastral Data**.

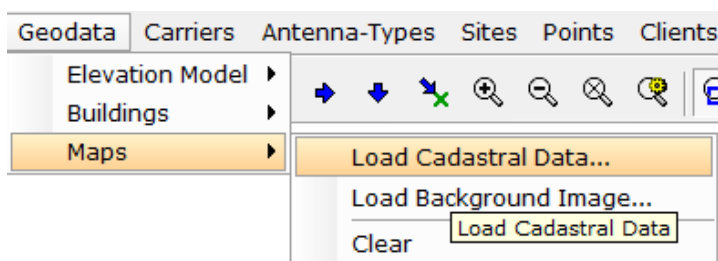


Figure 115: Load cadastral data

2. When the configuration window appears some settings need to be done. It is possible to import single as well as multiple cadasters.

*Activate single or multiple file import and click on **Choose**.* Choose a file or a folder to import multiple files. If a file path is known, it can be entered directly into the box.

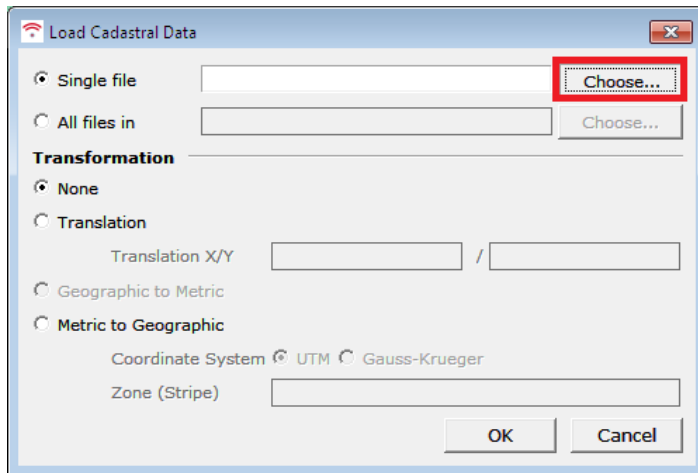


Figure 116: Choose a file

3. Choose the transformation settings and click on *Ok*. Transformation need to be made according to the coordinate system used by the project. In most times a translation needs to be made because .dxf files do not hold specific location coordinates.

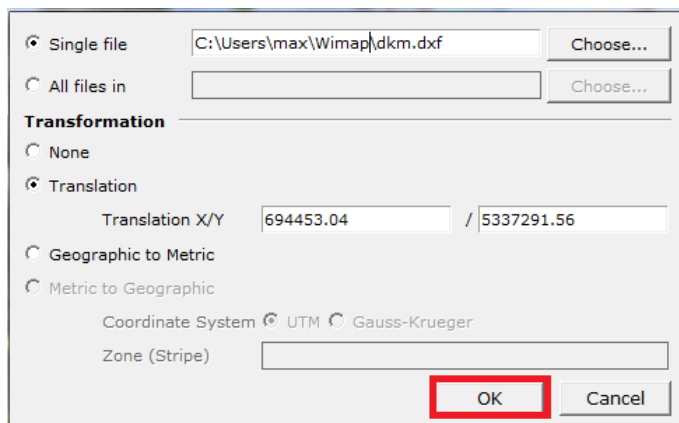


Figure 117: Click OK to add the cadastral data to the project

Subsequent a cadastral model appears at the specific place and additional layers appear at the project explorer. The number of layers differ in .dxf files depending on the specific data ordered by the land survey register.

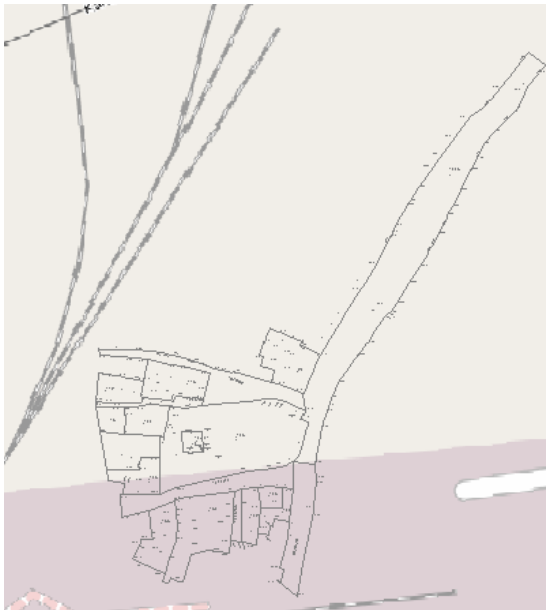


Figure 118: Unmodified cadastral data

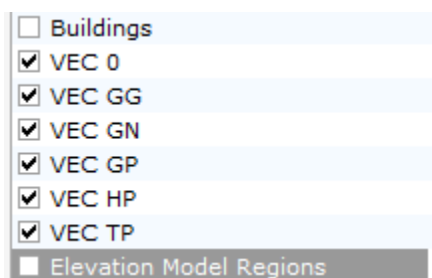


Figure 119: Additional cadastral layers

In this example there are six different layers available for the cadastral data. They include the 0-layer which is always available in cadastral data and some special layers like land name, land border or vegetation.

4.1.2 DXF Settings

The DXF settings can be found in **Project→Properties→DXF**. At the top it can be chosen whether .dxf files should be enabled or not. This is simply the same option as activating or deactivating the .dxf layers in the Project-Explorer. Below this option a scale of cadastral data can be set to a minimum or maximum value. Both values are set to maximum and minimum scale by default. With these values, the cadastral model can always be seen independently from the zoom factor.

At the bottom of the DXF settings the specific layers can be edited. Color can be changed as well as priority of the specific layer or the visibility. If desired, layers can be deleted, too.

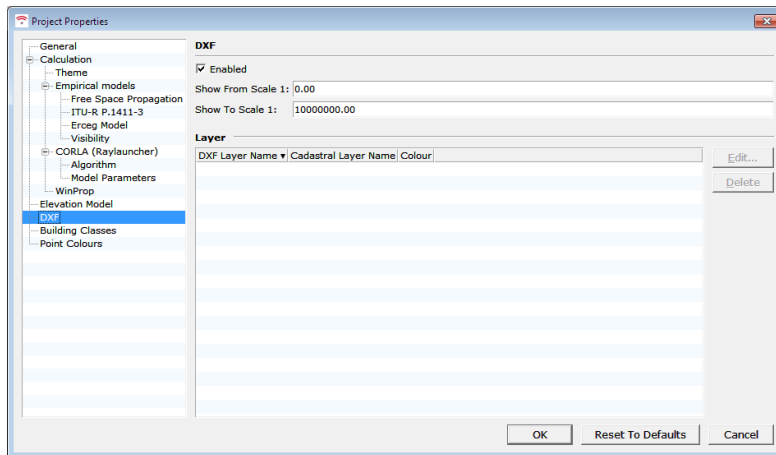


Figure 120: The cadastral data settings tab



4.1.2.1 How to Edit Cadastral Data Layers

1. Open **Project→Properties→DXF**.

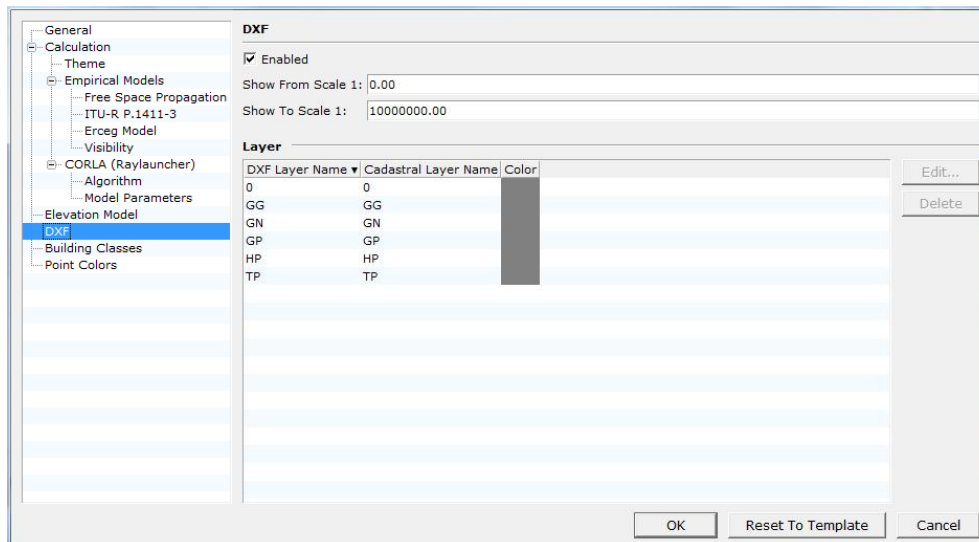


Figure 121: The cadastral data settings tab

2. At the bottom of the window, *double-click the desired layer or choose the layer and click on **Edit***. The layer configuration window appears.

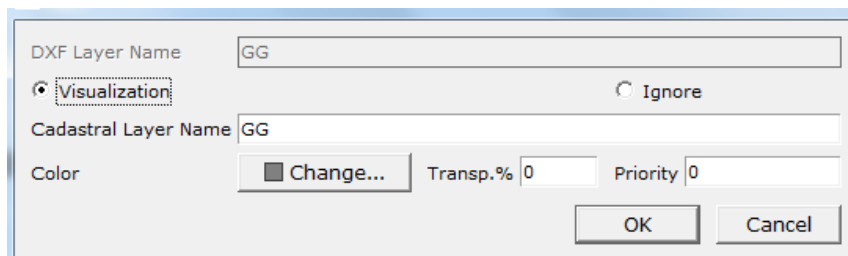


Figure 122: Choose Visualisation or Ignore

3. Decide whether a layer should be visible or not by choosing **Visualization** or **Ignore**.

4. *Rename the layer.* This is useful to keep track if there are many layers.

5. *Change the **color**, **transparency** and **priority** of the layer.* Priority can be set between 0 and 1.000. Layers with higher priority always crossfade layers with lower priority.

*Click on **Ok**.*

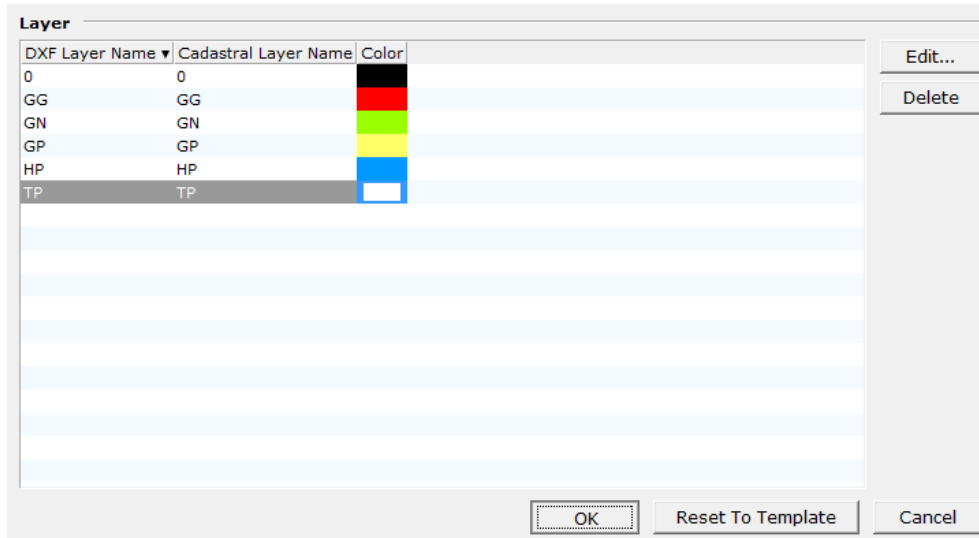


Figure 123: Edited cadastral layers

6. If everything went well, the cadastral model should have changed colours.

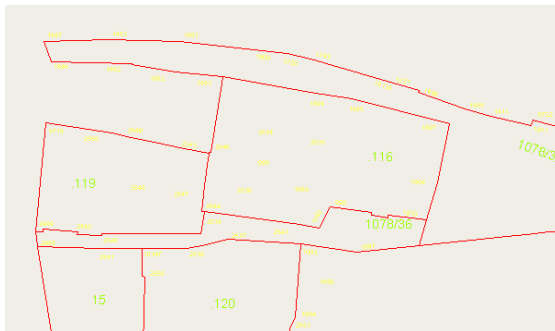


Figure 124: Cadastral data changed colour

In the **cadastral data tab** of the **Project-Explorer**, the cadastral data can be deleted from the project.

Figure 125: The cadastral data tab

4.2 Elevation Models

Elevation models are a basic feature of WiMAP-4G. They are essential in a project. They should ideally be imported when creating a preconfigured project. Elevation models are needed for proper use of the Terrain-Profiler and propagation model calculations. They will always be more efficient if an elevation model is available. Elevation models show the heights of every point in the selected area within the Terrain-Profiler. A manual import is hypothetically possible but the .asc or .asg file format which is required is not available on the free market.



4.2.1 How to Import an Elevation Model

1. Open **Geodata**→**Elevation Modell**→**Load From File**.

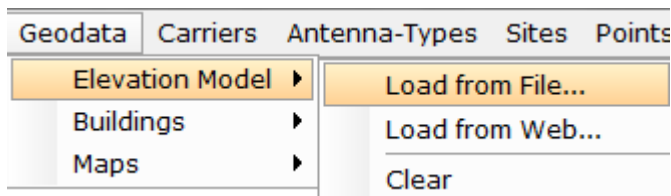


Figure 126: Load an elevation model

2. Choose **File** and click on **Ok** to import the elevation model.

If the **elevation model** was imported successfully it should be shown in the elevation tab of the Project-Explorer.

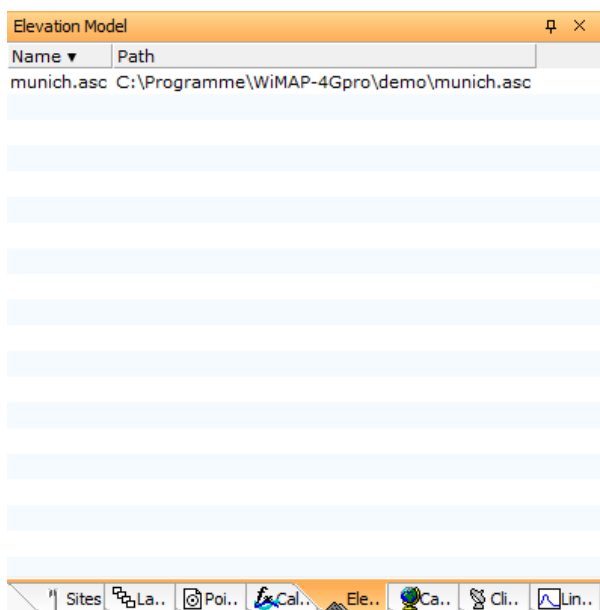


Figure 127: The elevation model tab after importing elevation models

4.2.2 How to Reload an Elevation Model from Web



1. Choose **Geodata**→**Elevation Model**→**Load from Web**.

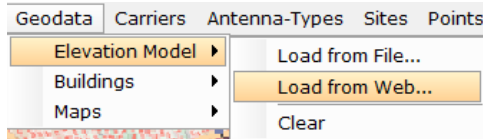


Figure 128: Reload elevation model from web

The current elevation model will be replaced with the new one.

2. Choose **Replace** to delete the old elevation model.

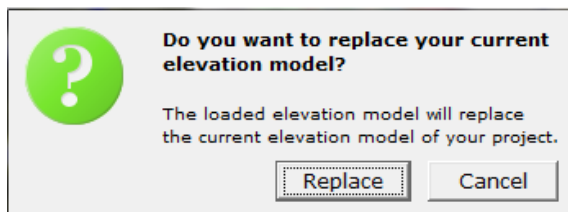


Figure 129: Choose to replace the current elevation model

3. Choose the **radius** for the new elevation model and decide whether the missing SRTM values should be added or not.

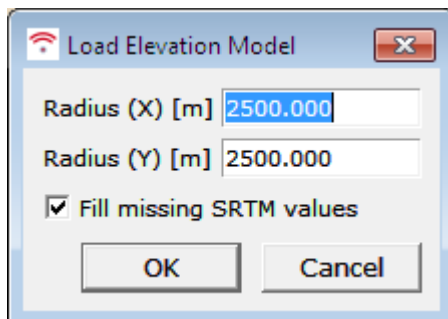


Figure 130: Choose radius for the new model

Click on **OK** to load the elevation model.

WiMAP-4G will automatically replace the old one.

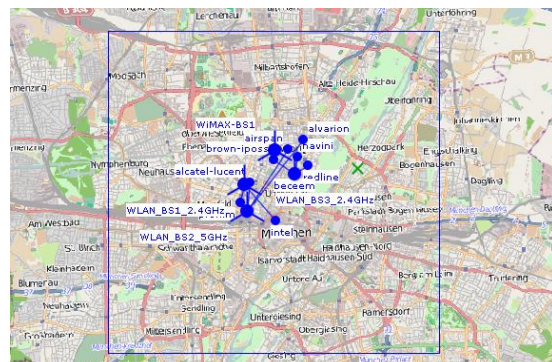
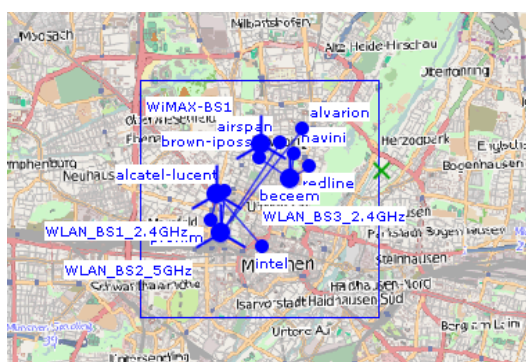


Figure 131: The new model will replace the old one

4.3 Background Images

The next object that can be imported is a background image. WiMAP-4G can download a background image automatically while creating a preconfigured project. After creating an empty project a background image can be downloaded manually using Oneearth or other providers of satellite images. Format can be .tif, .tiff, .gif or .png.



4.3.1 How to Import a Background Image

1. Open **Geodata**→**Maps**→**Load Background Image**.

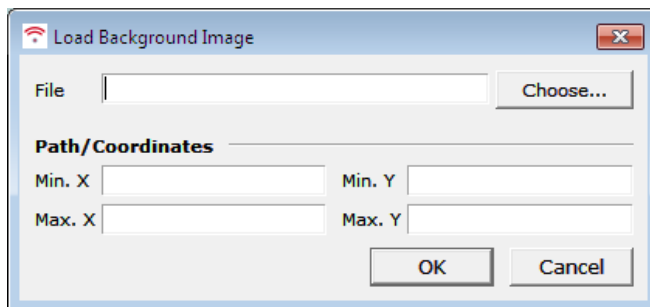


Figure 132: The import dialog

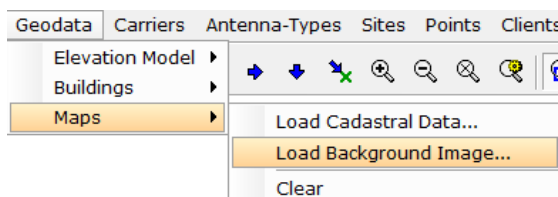


Figure 133: Load a background image

2. Choose a file with **Choose** or enter a **File** path.

3. Enter the coordinates where the image should be placed at and click **Ok**.

The Min. X and Min. Y coordinates are found in the left lower corner. The Max. X is the coordinate in the left upper corner.

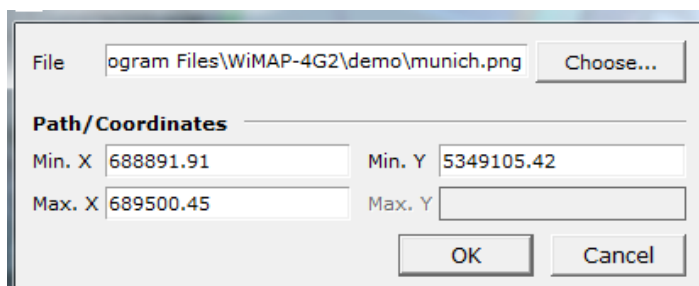


Figure 134: Fill in all field and click OK

5 Buildings

Buildings and wood are structures needed for detailed calculations. Creating and/or importing those structures is necessary to achieve exact calculations. Every calculation is nearly useless if buildings and/or wood have not been included. There are different methods to create or import these structures - they are explained in this chapter.



Figure 135: ITU-R P.1411-3 field strength calculation including buildings

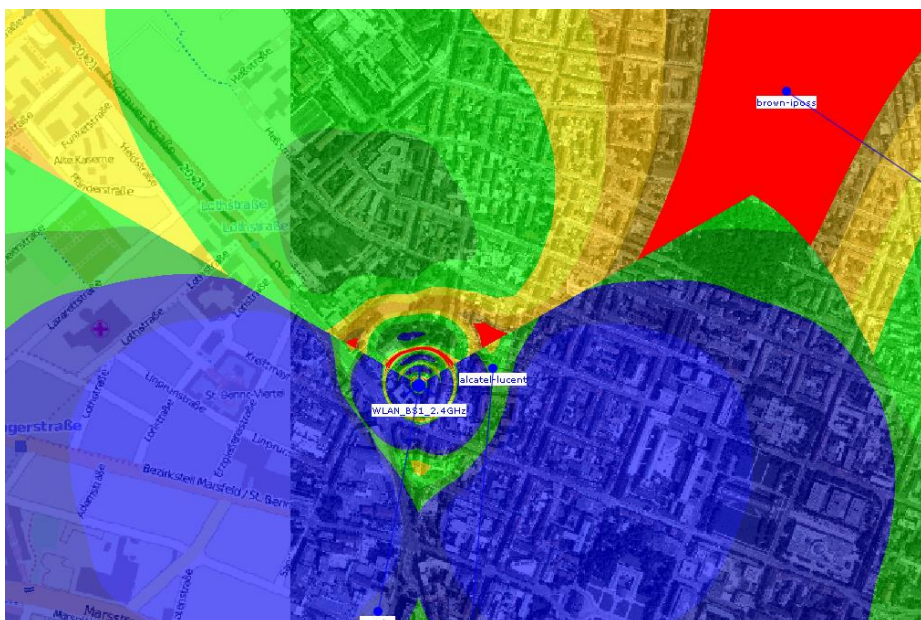


Figure 136: ITU-R P.1411-3 field strength calculation without buildings

5.1 Create Buildings

Create buildings is a matter of importance but it is not as easy as some users may think. For a proper creation of structures the correct coordinates, length and height should be known. Create buildings, where there are no actual buildings, or shift buildings a few meters away due to incorrect coordinates, can doom a project to failure. Shifting may cause bad results which makes it hard to realize the project, or worse, a project seems to work in the program but actually there are big field strength problems.



This section refers to buildings, but wood can be imported in the very same way.



Buildings should be created to the best of ones knowledge to eliminate possibility of future problems.



5.1.1 How to Create Buildings

1. Open **Geodata**→**Buildings**→**Capture**.

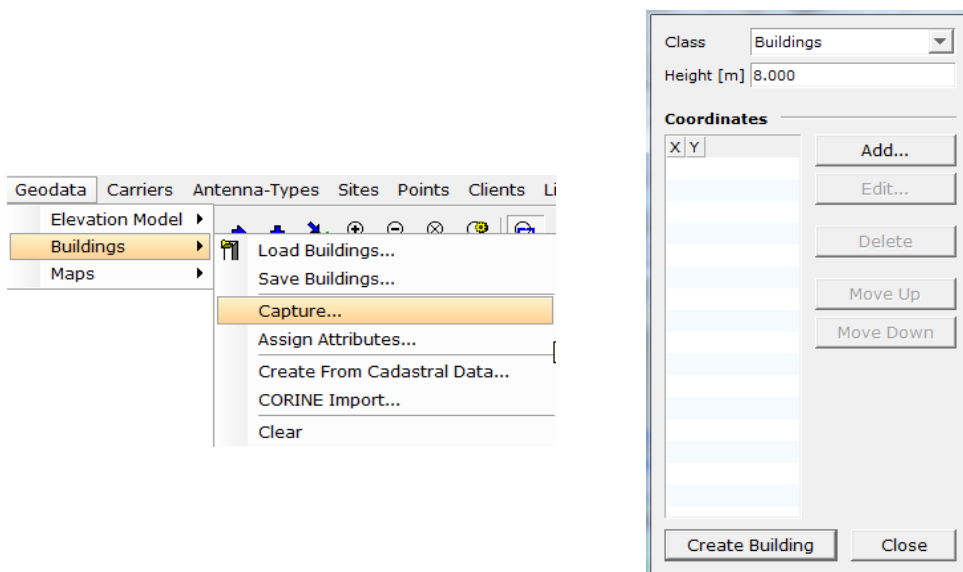


Figure 137: Capture buildings

2. There are two ways to create buildings or wood:

- For the exact but slow method watch 3.1-3.4.
- For the fast method watch 4.1-4.2.

3.1 Add buildings by entering the exact coordinates: This is for sure the more precise method to create buildings but therefore it is more time-consuming.

Click **Add** and enter the building coordinates. These need to be the coordinates of the building corners. For example a rectangular building needs four coordinates whereas a roundel needs much more depending on the precision that should be reached.



The first and the last coordinates connect each other automatically. That is why there are only four coordinates for example for a rectangular building instead of five.

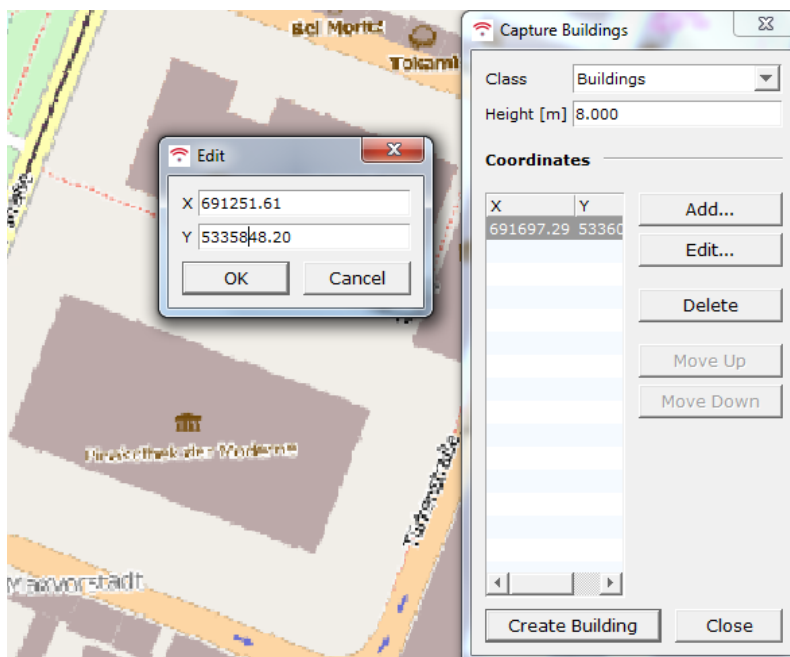


Figure 138: Add the first coordinates

3.2 Click on **Ok** to set the first coordinate.

A blue dot should appear to show the entered coordinate.

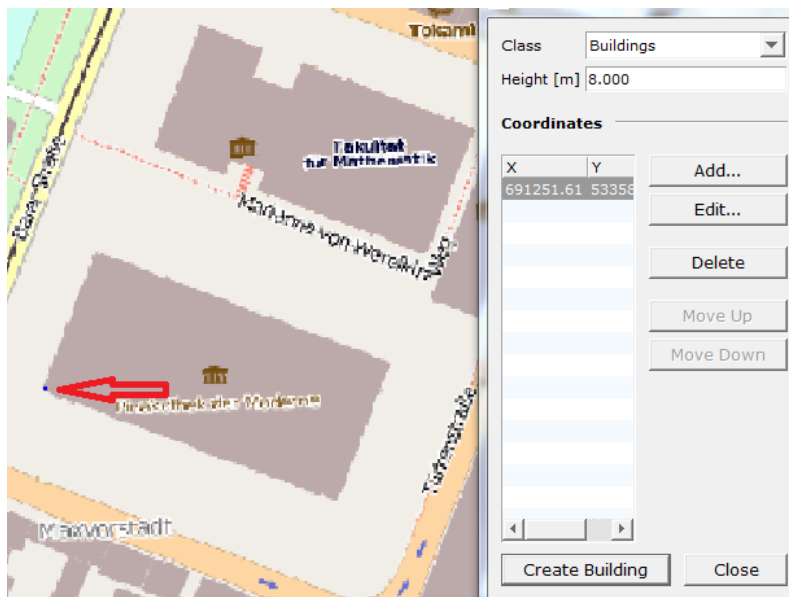


Figure 139: The blue dot shows the coordinates

3.3 Add more coordinates depending on the building type.



Note, that the coordinate order should be consistent. The order can be modified afterwards by clicking on the specific coordinate pair, hold the mouse button and shift the coordinates to the desired position.

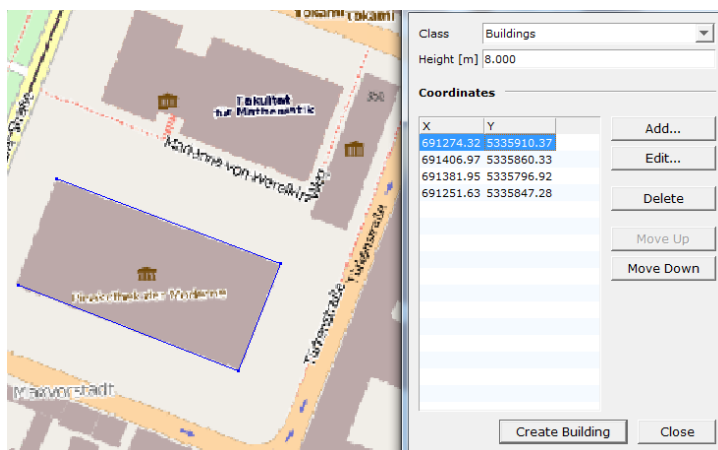


Figure 140: All coordinates added

After all coordinates have been entered there should be blue lines which border the building.

3.4 Make sure to apply the right height for the building. Click on **Create Building**.

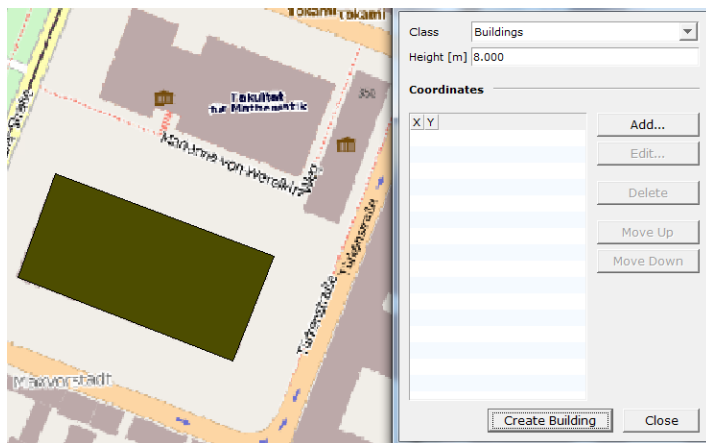


Figure 141: A created building

4.1 Add buildings with drag and drop: This is the fast method. It can also be precise if it is done correctly. OpenStreetMap offers the exact coordinates for a specific environment. *Simply click on the corners of buildings in the exact order to connect the points automatically.*

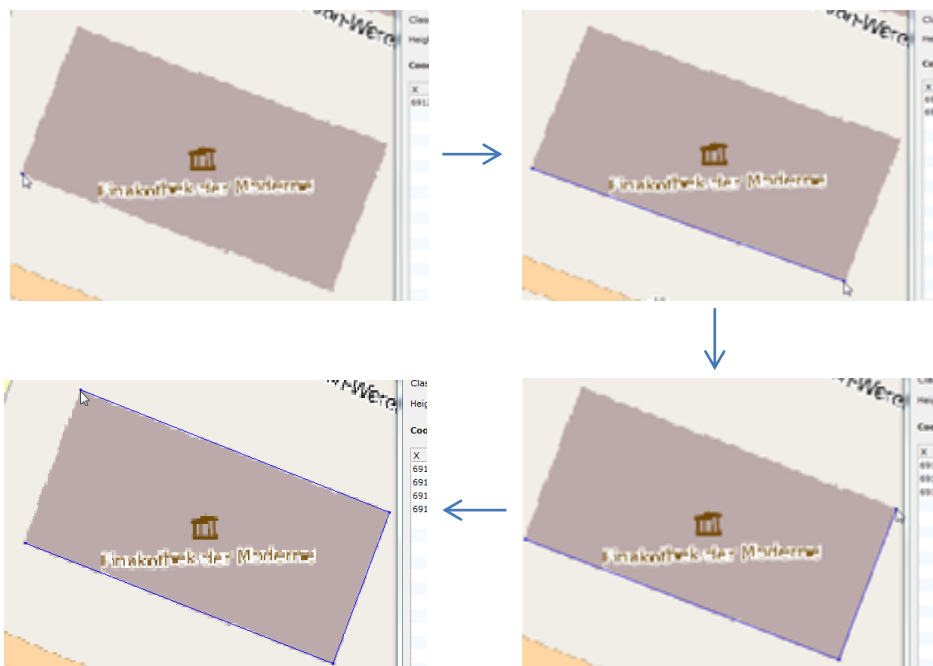


Figure 142: Add all corners

4.2 After all coordinates have been captured, make sure to apply the right height for the building. *Click on **Create Building**.*



Figure 143: Building added via drag and drop

5.1.2 Advanced Buildings

As many users realize in a project, there is more than just create a building. Maybe there are buildings with a courtyard or something similar.



5.1.2.1 How to Create Courtyard or Similar in Buildings

1. Open Geodata→Buildings→Capture.

2. Choose the building class that is used for the building wanted to edit.

3. Simply add the coordinates of the courtyard or drag and drop it.

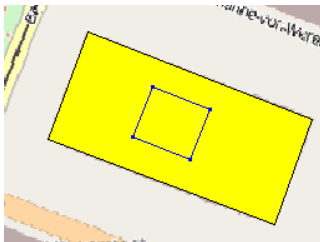


Figure 144: Add the courtyard

4. Click *Create Building*.

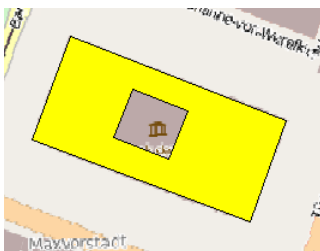


Figure 145: Courtyard

Sometimes there are buildings inside other buildings, buildings intersect other buildings or even there are towers on the roof of buildings. These buildings cannot be created without making a few arrangements.

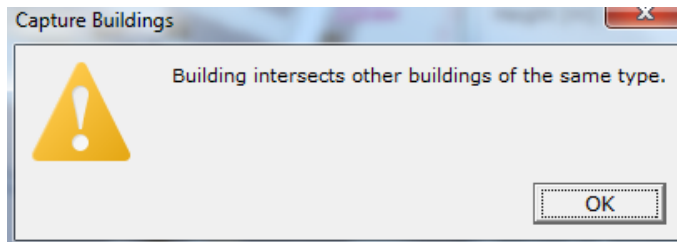


Figure 146: Intersecting buildings of the same type is not possible

Each building has a type id. The problem is that buildings with the same type id cannot intersect. As mentioned in chapter 3.1.5 there are building classes which need to be created for intersection. For bigger projects many building classes are needed as well as many wood classes.

ID	Name	Indoor Loss	Attenuation	Color From	Color To	
0	Standard_Building	Yes	10.00 + 0.00 * length[m]	100.000		Add...
1	Broadleaf_Forest	Yes	10.00 + 0.00 * length[m]	100.000		Edit...
2	Mixed_Forest	Yes	10.00 + 0.00 * length[m]	100.000		Delete
3	Coniferous_Forest	Yes	10.00 + 0.00 * length[m]	100.000		Attenuations...
4	Tower	Yes	10.00 + 0.00 * length[m]	100.000		Colors...
5	Inside_Building	Yes	10.00 + 0.00 * length[m]	100.000		
6	Intersecting_Building	Yes	10.00 + 0.00 * length[m]	100.000		

Figure 147: More building-classes make it more comfortable to plan and to make differences clearly visible.

These building classes are available in the capture building dialog. They can be used to create nested buildings or woods.

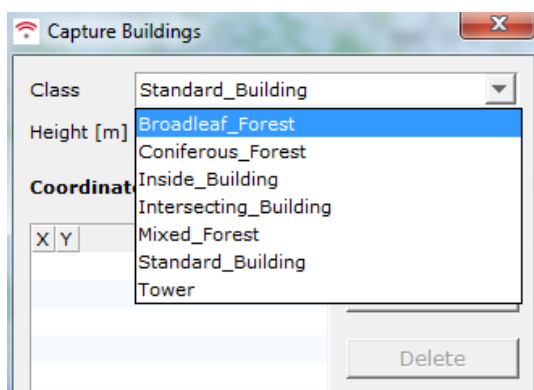


Figure 148: The created classes can be used



5.1.2.2 How to Add Intersecting Buildings

Assuming that more building classes has been added.

1. Open *Geodata*→*Buildings*→*Capture*.

2. Create a building as described in 5.1.1.



Figure 149: A new building

3. Choose other building classes, for example a tower, and build it inside the first building.



Figure 150: Intersecting buildings and wood

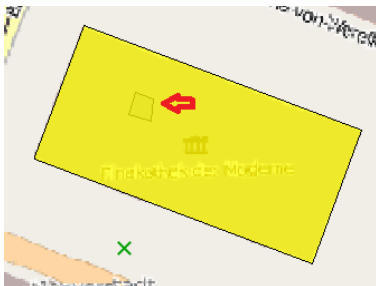


Figure 151: Building in building

A tower has been created and placed inside the other building without any error or warning message.



To make buildings inside other buildings clearly visible, just make a few visibility adjustments in the building classes settings.

5.2 Export Buildings

Buildings can be exported from WiMAP-4G to import buildings to other programs or to WiMAP-4G itself for a different project.



5.2.1 How to Export Buildings

1. Choose **Geodata->Buildings->Save Buildings**.

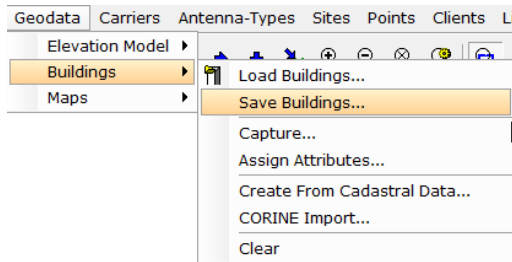


Figure 152: Choose save buildings to export buildings

2. Choose a directory, pick a desired name for the export file and click on **OK**.
After exporting the .mif file can be found in the chosen save directory.

5.3 Import Buildings

Buildings can be imported as easy as they can be exported. The files need to be .mif files so make sure that they come in this format.



5.3.1 How to Import Buildings

1. Choose **Geodata**→**Buildings**→**Load Buildings**.

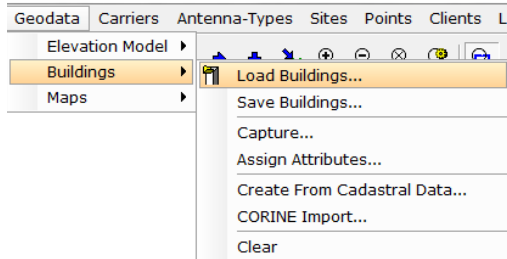


Figure 153: Choose load buildings to import buildings

2. Choose the desired .mif file and click **OK**.

All buildings included in the .mif file has been imported now and can be edited and/or deleted as usual.

5.4 Create Buildings Using Cadastral Data (Professional-Edition)

Buildings can be created using the **cadastral data**. This is an advanced feature and therefore only available for Professional-Edition customers. Only the cadastral data is needed which can be purchased at the local land survey register. Import buildings with cadastral data is more precise than creating them, because the cadastral data is a professional product made by engineers. OpenStreetMap, which is mostly used to get an impression where to create buildings, is an open project and therefore not immune against individual caused errors.



5.4.1 How to Create Buildings Using Cadastral Data

Assuming, that cadastral data has been loaded and contains a building layer.

1. Choose **Geodata**→**Buildings**→**Create from Cadastral Data**.

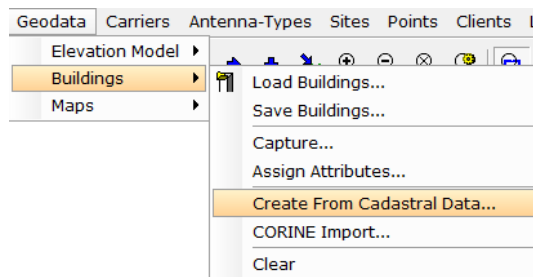


Figure 154: Create buildings from cadastral data

2. Choose the layer that contains the structures in the appearing window. Choose the structure depending on the available **building classes**. The last important information is the structure height. The height of 8 m is default and should be used, if the user is not sure how high the buildings are.

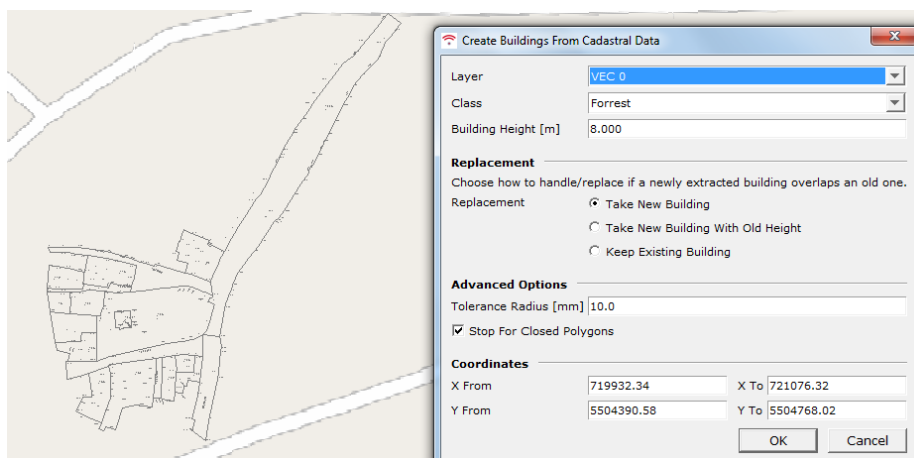


Figure 155: Import settings

3. There are advanced settings for imports, too. Decide what happens in case new buildings intersect old buildings, in the replacement options.

Replacement Settings:

- **Take new building:** Old buildings are overwritten if new buildings intersect them.
- **Take new building with old height:** Old buildings are overwritten by new but they keep their height.
- **Keep existing building:** Old buildings can not be overwritten.

The exact coordinates of the cadastral data position is needed to place the buildings on the right position of the map.

*After filling all the needed information, click on **OK** to create the buildings.*

All the buildings in the building layer are created.

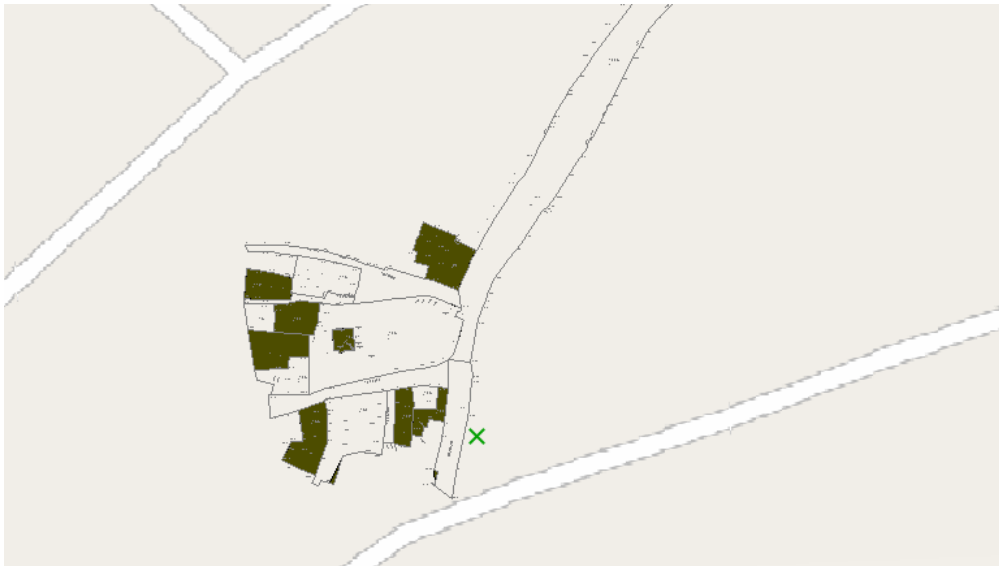


Figure 156: Buildings created from cadastral data

5.5 Create Buildings Using Corine (Professional-Edition)

Creating buildings with **corine data** is a feature of the Professional-Edition. The Corine Land Cover is a project established by the European Environment Agency to classify a computerized inventory of the land cover in European countries. Therefore it is an optimal source for buildings, wood and other important objects needed by WiMAP-4G to create a proper calculation. Corine data can be downloaded from the EEA-Website.



5.5.1 How to Create Buildings Using Corine Data

1. Choose **Geodata**→**Buildings**→**Corine Import**.

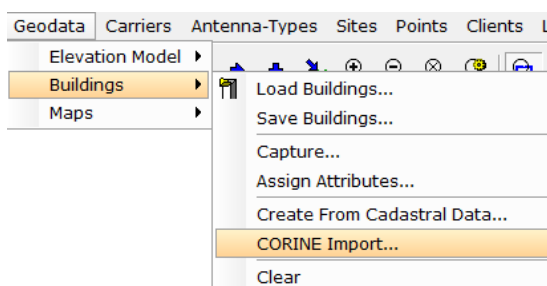
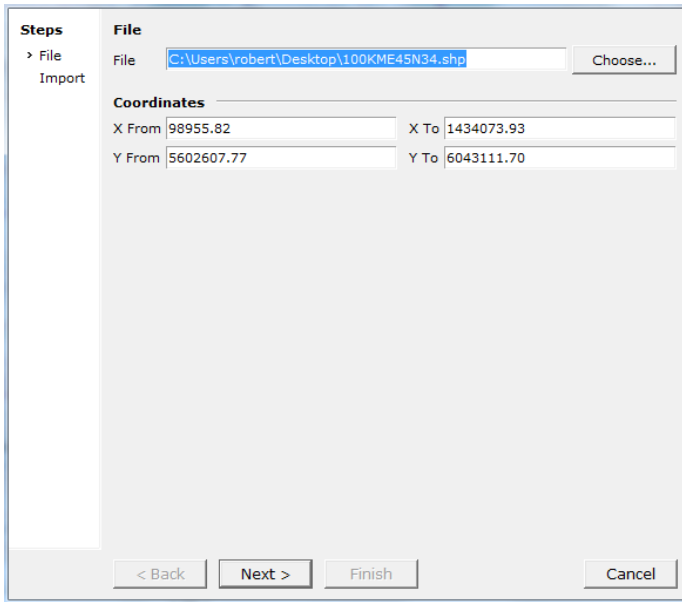


Figure 157: The Corine import

2. Choose a file, fill in the coordinates of the desired environment and click on **Next**.



Steps

- File
- Import

File

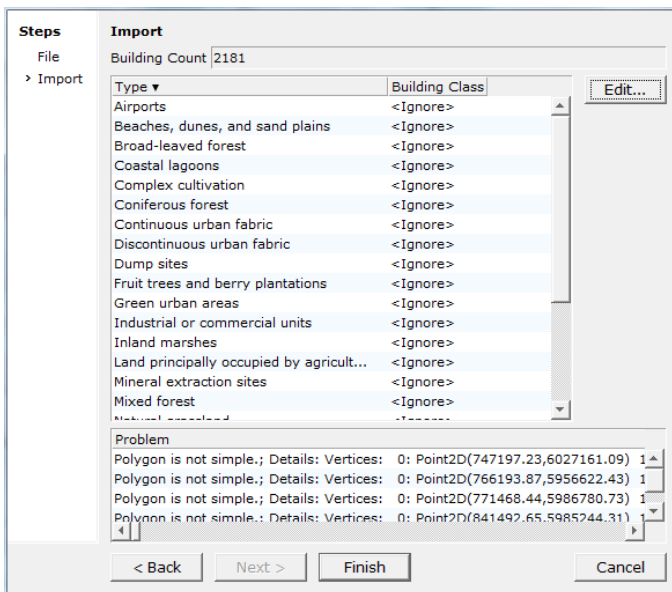
File:

Coordinates

X From	98955.82	X To	1434073.93
Y From	5602607.77	Y To	6043111.70

Figure 158: Corine settings

3. After the environment details are loaded, the following windows should appear:



Steps

- File
- Import

Import

Building Count: 2181

Type	Building Class	Edit...
Airports	<Ignore>	
Beaches, dunes, and sand plains	<Ignore>	
Broad-leaved forest	<Ignore>	
Coastal lagoons	<Ignore>	
Complex cultivation	<Ignore>	
Coniferous forest	<Ignore>	
Continuous urban fabric	<Ignore>	
Discontinuous urban fabric	<Ignore>	
Dump sites	<Ignore>	
Fruit trees and berry plantations	<Ignore>	
Green urban areas	<Ignore>	
Industrial or commercial units	<Ignore>	
Inland marshes	<Ignore>	
Land principally occupied by agricult...	<Ignore>	
Mineral extraction sites	<Ignore>	
Mixed forest	<Ignore>	
Non-irrigated cropland	<Ignore>	

Problem

Polygon is not simple.; Details: Vertices: 0: Point2D(747197.23,6027161.09) 1

Polygon is not simple.; Details: Vertices: 0: Point2D(766193.87,5956622.43) 1

Polygon is not simple.; Details: Vertices: 0: Point2D(771468.44,5986780.73) 1

Polygon is not simple.; Details: Vertices: 0: Point2D(841492.65,5985244.31) 1

Figure 159: Imported structures

The building count shows the actual number of structures imported from the corine data file.

4. All structures are ignored by default because the user should choose himself, which buildings he wishes to import.

*Simply double-click on the desired structure or select it and click on **Edit**.*

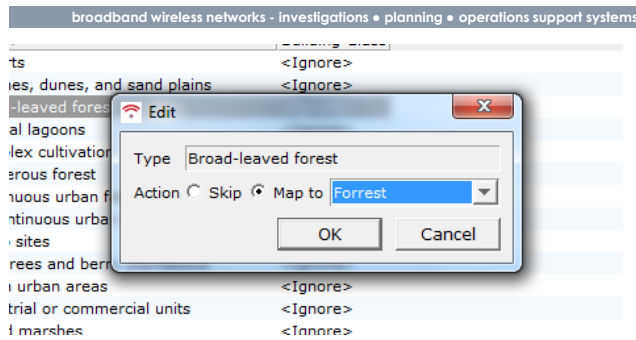


Figure 160: Corine imports need to be mapped to a building class

Set Action to **Map To** and select the corresponding structure.



Additional structures can be added or edited in the WiMAP-4G settings. See chapter 3.1.5 for more information.

5. After mapping all desired structures to the corresponding building class, *click on **Finish***. The imported structures appear on the map.

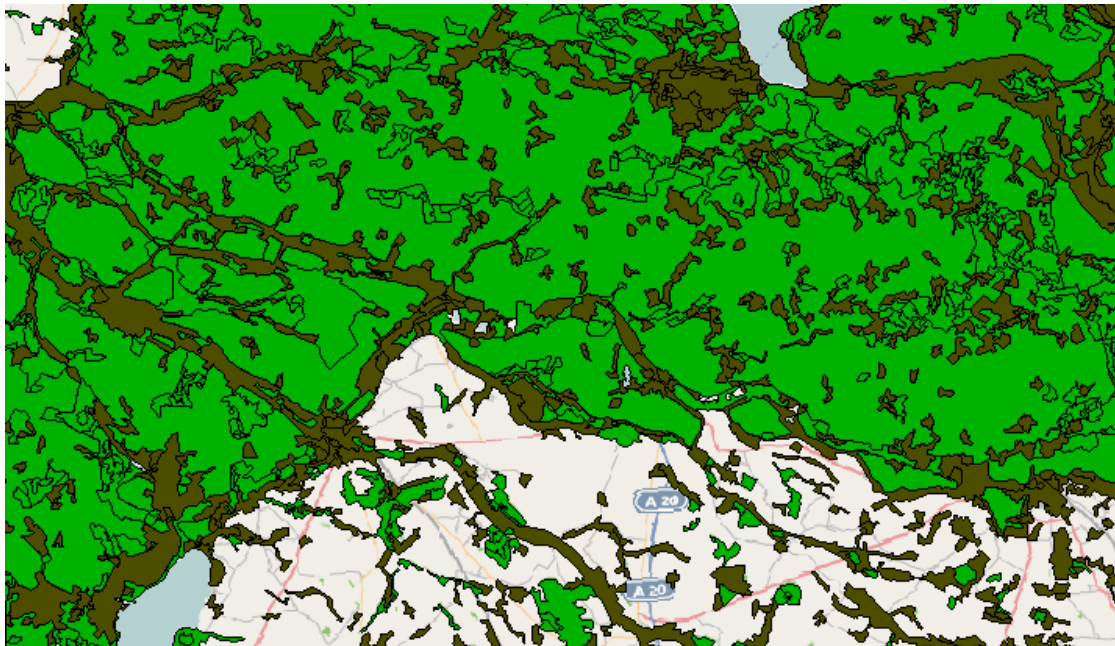


Figure 161: A whole region created with corine imports



Additional buildings can be added by loading the same corine file again.

5.6 Clear Building Cache

Clearing the building cache, deletes all buildings from the project.

5.6.1 How to Clear Building Cache



1. Choose ***Geodata***→***Buildings***→***Clear***.

All buildings will be deleted.

6 Carrier

Carriers are waveforms modulated with a specific input signal for the purpose of conveying information on the air-interface in the case of WiMAP-4G. In WiMAP-4G the following carrier types are available and preconfigured:

- **WLAN 2.4 GHz:**
 - 100 mW (10 mW) allowed transmission power, high availability and therefore lower costs for equipment
 - sharing channels with other sites is expected
 - 13 (11) overlapping and /or 3 non-overlapping channel
 - 2.400-2.484 MHz spectrum

- **WLAN 5.0 GHz:**
 - 1.000 mW allowed transmission power outdoor, less used frequency band and therefore interference-free connection possible
 - In general, equipment needs to provide dynamic frequency selection and transmission power control. It is expensive compared to the 2.4 GHz technology.
 - 24 non-overlapping channel:
 - 8 indoor channels (200 mW power)
 - 11 outdoor channels (1 W power)
 - 5 FBWA (4 W power)
 - 5.180-5.870 MHz spectrum

- **WiMAX** (Worldwide Interoperability for Microwave Access):
 - microwave signals for connection range up to 50 km therefore suitable for poorly accessible regions
 - comparable to WLAN except the range is much higher
 - 3.400-3.700 MHz spectrum

- **Backhaul:**
 - connection between core network and small sub networks
 - point to point and/or point to multipoint radio relay
 - frequency spectrum different, up to 38.5 GHz

- **Tetra** (terrestrial trunked radio, also known as Trans European Trunked Radio Access):
 - designed for use by government agencies, emergency services and military
 - low frequency spectrum and therefor huge range with high coverage
 - expensive and can interfere other sensible electronic devices like TV receiver
 - 380-470 MHz spectrum
- **Generic OFDM** (Orthogonal Frequency Division Multiplex):
 - high efficiency caused by nearly constant spectral power density
 - tough against interference
 - needs exact time and frequency synchronization
 - 470-870 MHz spectrum



6.1 How to Create or Edit Carrier

1. Choose *Carriers*→*Edit*.

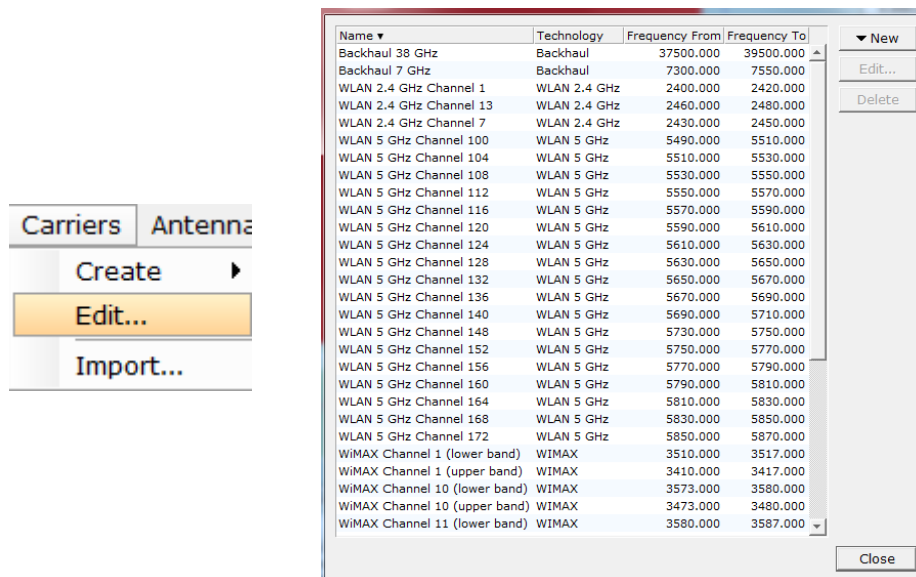


Figure 162: Click Edit Carriers to show a list of all carriers

2. To create a new *carrier* click **New** and select the desired carrier type. To edit a carrier type, double-click it or choose it and click on **Edit**. A carrier can be deleted by selecting it and click **Delete**.

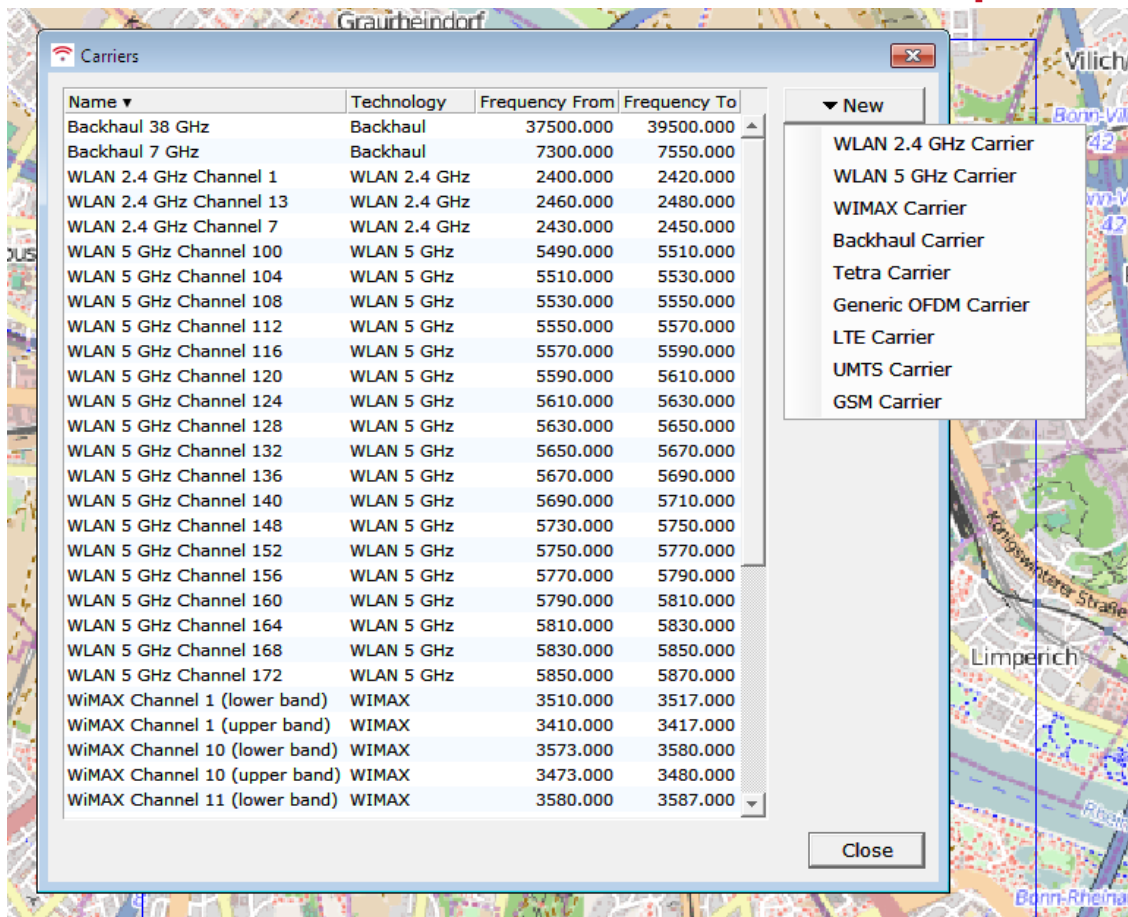


Figure 163: Choose New to create a new

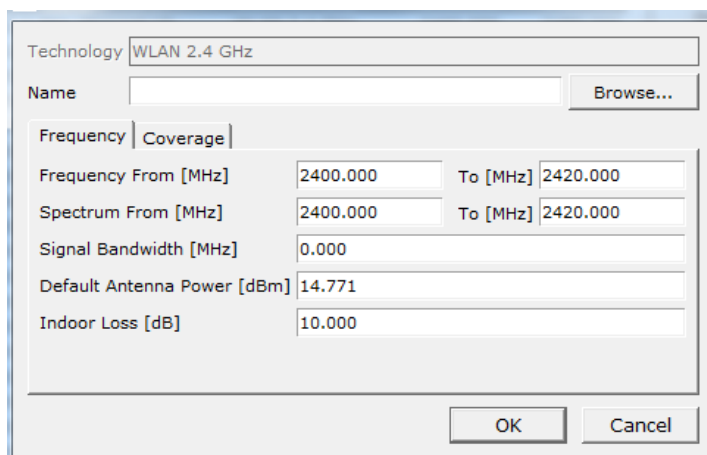


Figure 164: The carrier configuration window

A carrier can be created by choosing **Carriers**→**Create**, too.

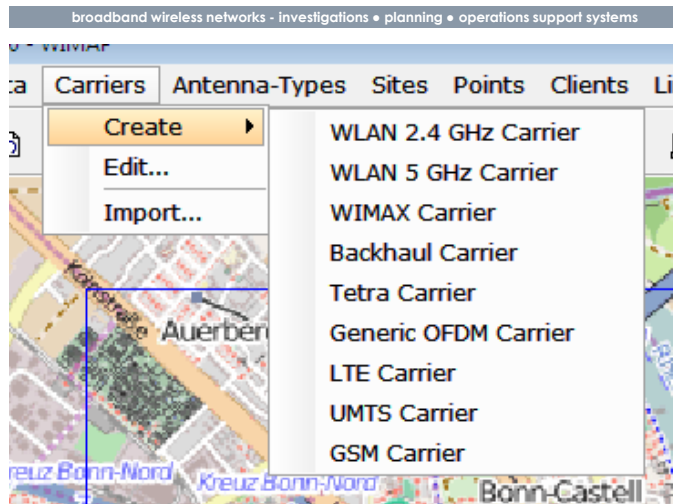


Figure 165: The fast way to create a carrier

3. Configure the carrier and always keep the specifications for the specific carrier in mind. A 2.4 GHz WLAN should not have a frequency spectrum up to 5 GHz.

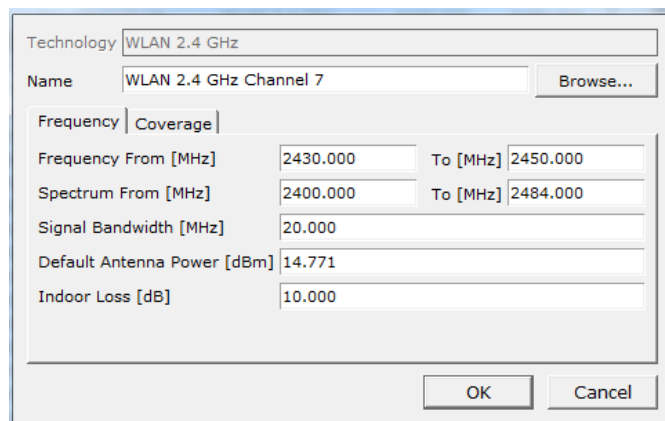


Figure 166: Configured carrier

4. Click **Coverage** and edit the coverage options according to the chosen carrier type.

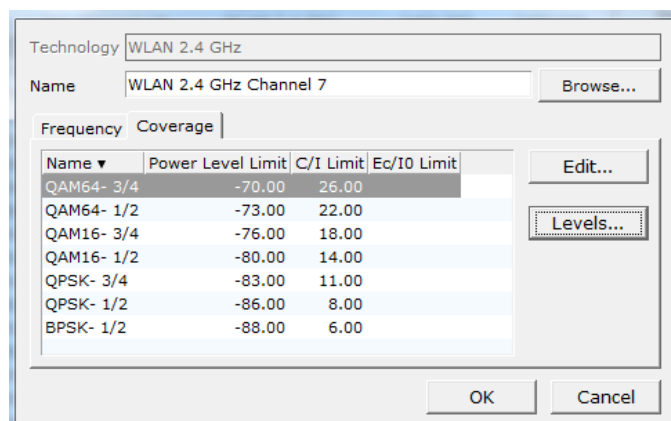


Figure 167: Coverage settings

Coverage is preconfigured for every carrier type but the specific values can be changed by *clicking **Edit***. Color options can be changed by *clicking on **Levels***. To add a new value, a level needs to be created first. *Click **Levels**→**Add***, add the specific values and *click on **Ok***. Now the parameters of this new value can be set with **Edit**.

5. If all necessary carriers have been created or edited, click on **OK**.

6.2 Import Carrier

Importing carrier is possible with WiMAP-4G. Both, importing carrier information from other projects to the active working set and importing carrier data from other programs that allow exporting data in .rad format is provided. This feature can be useful to import carriers for the specific country and restrictions of this country. Carriers used in European projects and also the program defaults may be useless in other country for example in America. With this feature the American carriers can be imported and do not need to be created for every project.

6.2.1 How to Import Carrier



1. Choose **Carriers**→**Import**.

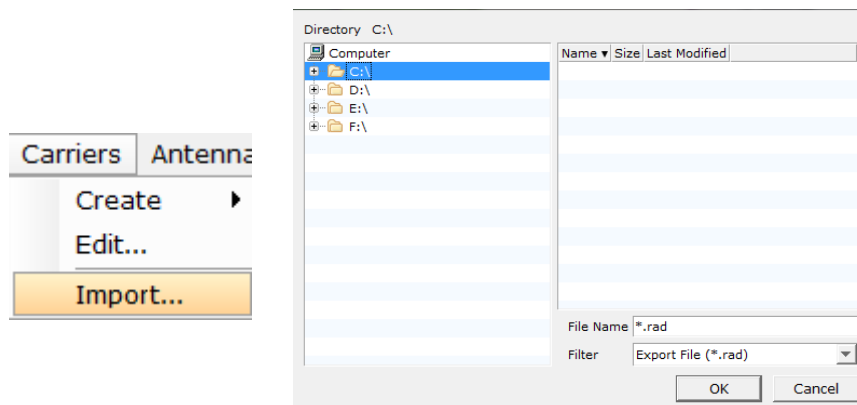


Figure 168: Import carriers

2. Choose the .rad file that holds the new carriers and click on **OK** to import these carriers. If everything worked out successful, the log shows the following information and the imported carriers are available now.

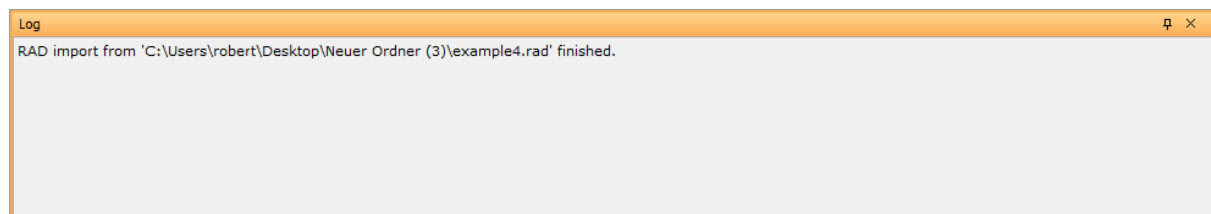


Figure 169: The log shows information for the current import

Existing carrier will not be replaced. Instead of replacing the log shows the following information:

Object WLAN 5 GHz Channel 156 (UUID=ea912e95-3251-440e-83c6-f1ec4efc4e5a) already exists and has not been replaced.

Figure 170: Existing carriers cannot be replaced

7 Sites and Antennas

Sites are one of the most important things that WiMAP-4G depends on. A project cannot be planned without sites because they are the main aspect of every calculation. There are different types of sites and antennas available and all of them have their advantages and disadvantages. An advanced knowledge of antenna types is useful to make projects succeed. For example since the costs of each antenna type differ, a project should not be expensive if that is not necessary. So every user should make some investigations on sites and antennas before continuing with this chapter. It is also necessary to take a look at the involved parameters used for antennas and calculations.

7.1 Antennas

There are a few preconfigured antennas, but depending on the project other may be needed to make a proper calculation. Different companies offer different antennas with different parameters. Antennas should be created to design the project as close to reality as possible.

7.1.1 Create Antennas

As mentioned before, new antennas sometimes need to be added to make calculations with the exact antenna type for a proper result. WiMAP-4G allows the creation of antennas with the help of patterns.



7.1.1.1 How to Create Antennas

1. Choose **Antenna-Types**→**Create** or **Antenna-Types**→**Edit** and click on **New**.

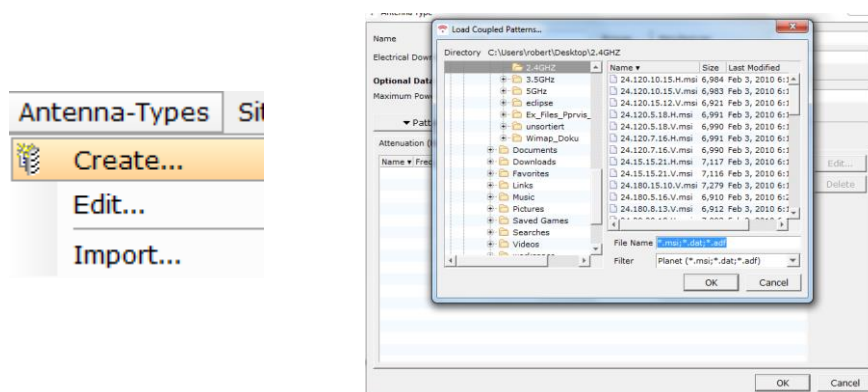


Figure 171: A pattern can be imported while creating antennas.

2. To create an antenna a pattern is necessary which contains all the information about the vertical and horizontal attenuation. These patterns can be loaded from files. The files need to be .msi, .dat or .adf. The patterns can be downloaded from the manufacturer site, but sometimes they need to be created manually. The pattern files can be chosen later. Pattern

files contain antenna names so there would be less input needed, if a pattern file was chosen right away.

Choose a file and click on **Ok** or **Cancel** to cancel the import.



A short introduction how to create pattern files can be found in chapter 7.1.2.

3. If no pattern file has been imported, *edit the name and manufacturer according to the desired antenna and choose electrical downtilt.* Advanced users can add **Maximum Power** and **Antenna Type Height**.

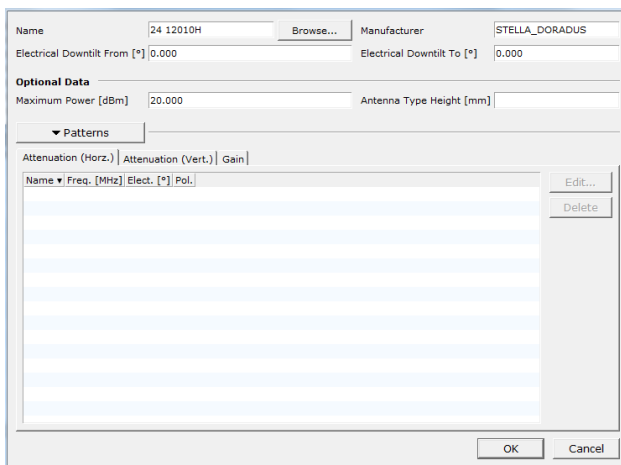


Figure 172: Fill in all fields

4. To complete the antenna creation a pattern is now necessary. Trying to complete the creation without a pattern brings up the following message.



Figure 173: A pattern is required for antenna creation

To load a pattern, *click **Patterns→Load single pattern***. If there are more than one pattern available for the same antenna, *click **Patterns→Load coupled patterns***.

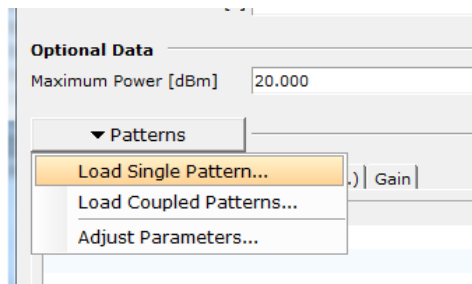


Figure 174: Load single or multiple patterns

5. Select a pattern which is either a .mis or a .dat or an .adf file and click on **OK**. If this is a valid pattern, a line will be added in the attenuation table.

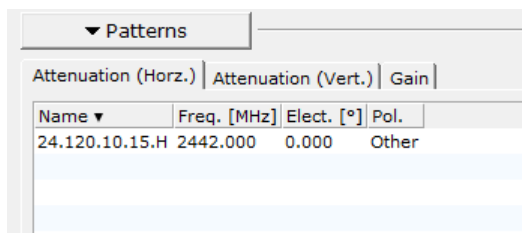


Figure 175: A valid pattern

6. The electrical downtilt for a patter can be edited by selecting the pattern and clicking on **OK**. A window appears and the downtilt can be changed for +/-45° and other.

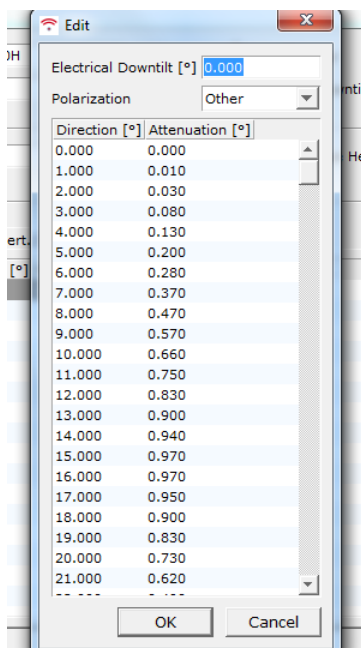


Figure 176: Antenna attenuation

If everything is edited and a pattern has been imported, click **Ok** to complete the creation. If there are any error messages, follow the instructions from 1-6. If everything went fine, the new antenna can be used while creating sites.

7.1.2 Editing Antennas

Sometimes antennas need to be edited.



7.1.2.1 How to Edit Antenna Types

1. Choose **Antenna-Types**→**Edit**.

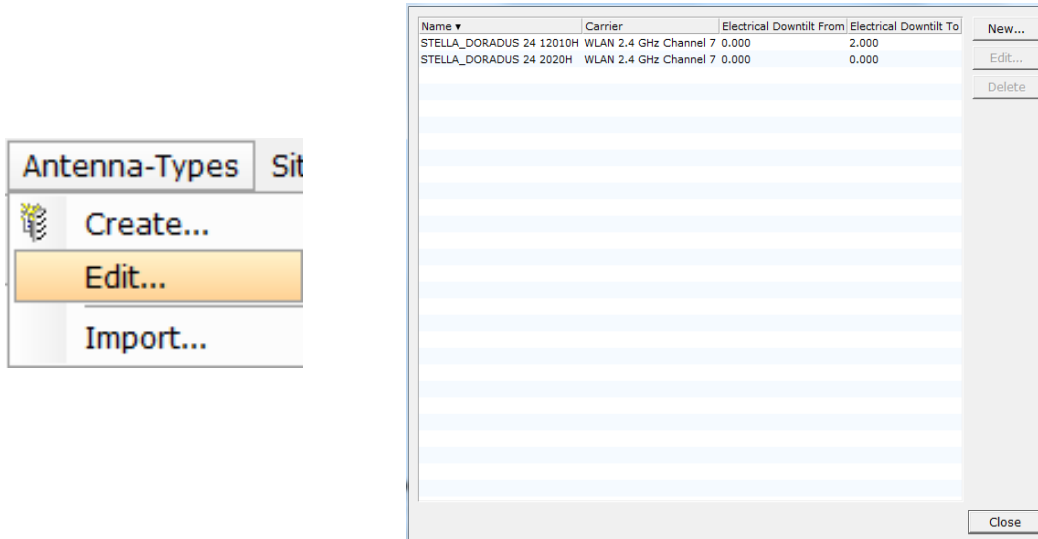


Figure 177: Edit antennas

2. Choose the antenna that should be edited and click on **Edit**. Antennas can be deleted by selecting the desired antenna and clicking on **Delete**.

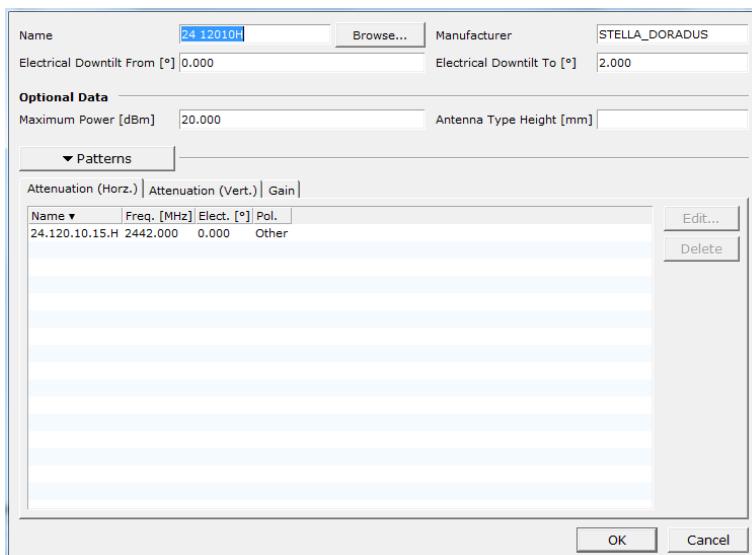


Figure 178: Change the fields

3. *Edit the antenna.* For details see 7.1.1. If everything has been edited, *click on OK*.

7.1.3 Import Antenna-Types

Importing antenna-types is possible with WiMAP-4G, too. Antennas can be imported from other projects or from other programs that support the .rad export. With this feature, specific antenna-types can be imported and does not need to be created for every project again and again.



7.1.3.1 How to Import Antenna Types

1. Choose **Antenna-Types**→**Import**.

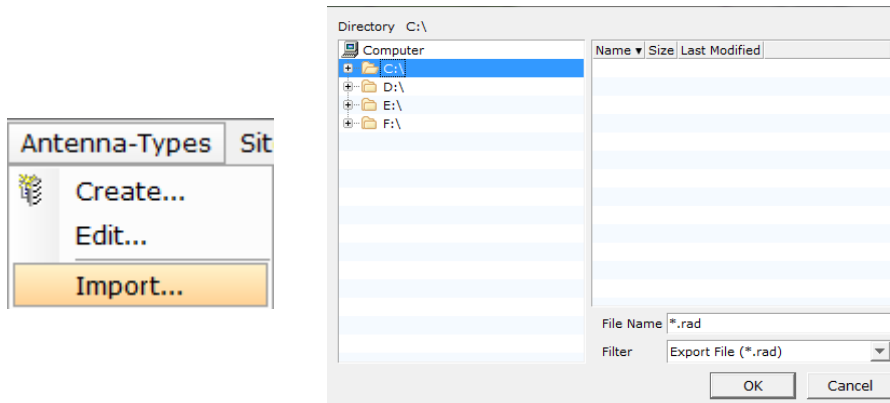


Figure 179: Import antenna-types

2. Choose the .rad file that holds the new antenna-types and click on **OK** to import these antenna-types. If everything worked out successful, the log shows the following information and the imported carriers are available now:

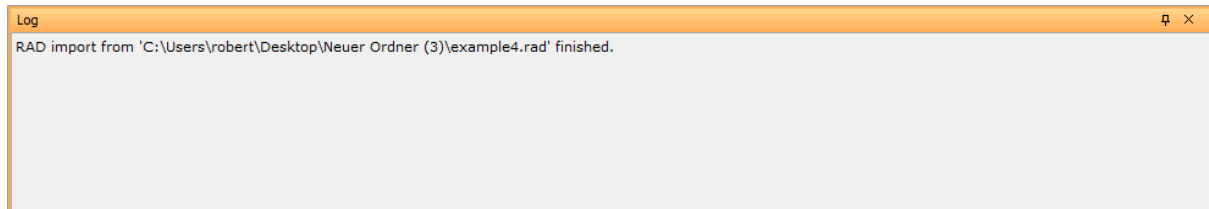


Figure 180: The log shows information for the current import.

Existing antenna-types will not be replaced. Instead of replacing the log shows the following information:

Object Stella-Doradus 24.90.10.16 (UUID=21b4e388-3916-4606-b6a6-acd81163d2dc) already exists and has not been replaced.

Figure 181: Existing antenna-types cannot be replaced.



7.1.4 How to Create a Pattern File

Creating a pattern file is necessary for importing an antenna in case the manufacturer does not offer pattern files for download. Only a text editor is needed to create those pattern files.

1. Open editor (Hold down Win-Button and press R, Type **Notepad** and click on **Ok**).

The editor should appear right away:

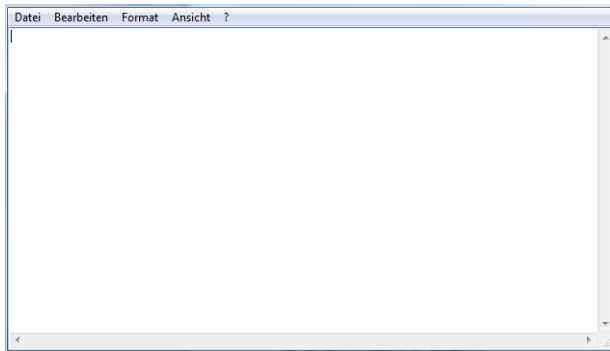


Figure 182: The windows editor

2. Parameter needed for pattern creation:

- **Description of the antenna**
- **Name of the antenna**
- **Frequency**
- **Horizontal and vertical angle of the signal created from the antenna**
- **Front to back ratio (power gain between front and rear of the antenna)**
- **Antenna gain**
- **Tilt (mechanical or electrical)**
- **Polarization of the antenna (horizontal or vertical)**
- **Attenuation parameters for 360° horizontal and vertical**

These parameters are all you need to create a valid antenna pattern with a text editor.

Add the following lines to the editor:

- **Description of the antenna:**
 - NAME 24.120.10.15
 - This is the standard description for antenna in WiMAP-4G.
 - 24: Antenna frequency (for this antenna 2.4 GHz)
 - 120: Horizontal angle
 - 10: Vertical angle
 - 15: Antenna gain in dBi
- **Name of the antenna:**
 - MAKE Stella Doradus

- Antenna name is Stella Doradus in this case.
- **Antenna frequency:**
 - FREQUENCY 2442
 - Depending on the frequency used change 2.442 to 3.500 for 3.5 GHz.
- **Horizontal angle:**
 - H_WIDTH 360
 - Horizontal angle can be a value between 0 and 360°.
- **Vertical Angle:**
 - V_WIDTH 9
 - Vertical angle can be a value between 0 and 360°.
- **Front to back:**
 - FRONT_TO_BACK 10
- **Antenna gain:**
 - GAIN 10 dBi
- **Tilt:**
 - TILT MECHANICAL
- **Polarization:**
 - POLARIZATION V
 - Set POLARIZATION H for horizontal polarization.

The editor should look like this:

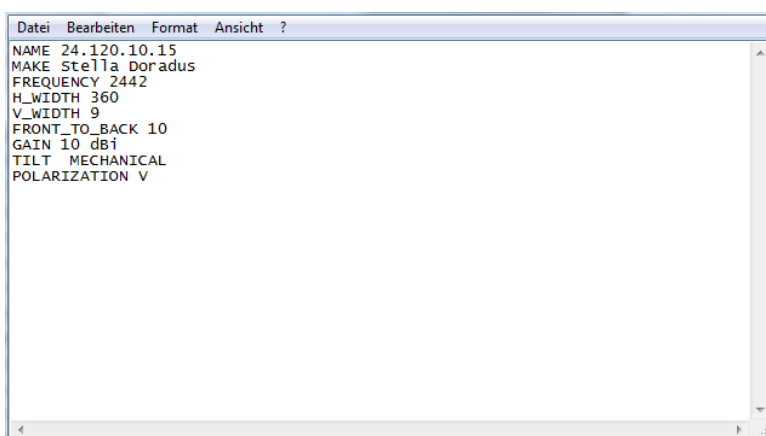


Figure 183: Editor with a few settings

3. Add the horizontal and vertical attenuation parameters from 0 to 360 using this style.

HORIZONTAL	360	VERTICAL	360
------------	-----	----------	-----

0	0	0	0
1	0	1	0.03
2	0	2	0.5
3	0	3	1.46
4	0.01	4	2.972
5	0.01	5	5.203
6	0.02	6	8.489
7	0.03	7	12.752
8	0.04	8	25.13
9	0.05	9	20.546
10	0.06	10	14.395
11	0.07	11	11.95524
12	0.09	12	11.1492
360	0	360	0

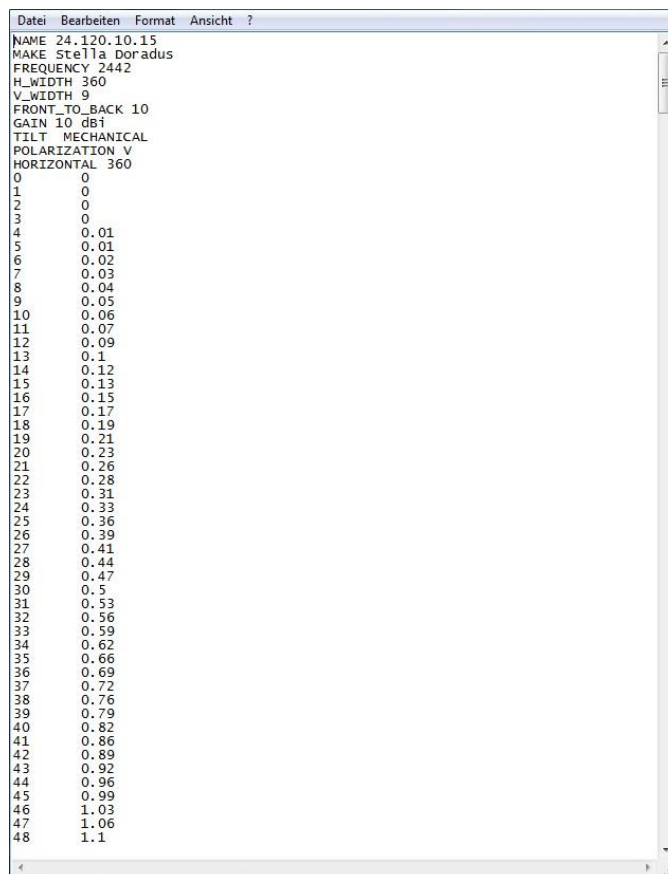


Figure 184: Editor with attenuation parameters

4. Choose **File→Save as** and save file as .msi.



Figure 185: Save the new file as .msi

There is a .msi file in the chosen file path right away, which can be used as a pattern for this antenna.

7.1.5 Export Antennas

To export antenna information from an existing project might be necessary to work in other projects with the same antenna set or to work with these antennas in other programs that allows antenna-import.



7.1.5.1 How to Export Antennas

1. Choose **Sites→Export Antennas**.

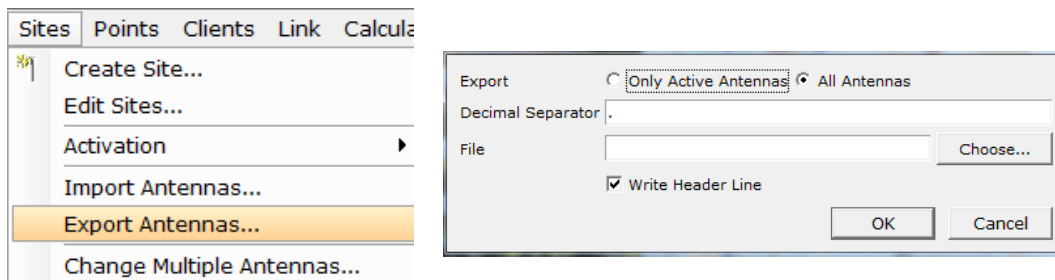


Figure 186: Export antennas

2. Choose whether to export all antennas which is set by default or only the active antennas. The decimal separator only affects the layout of the created .csv file.

Click on **Choose** to browse folders and enter a file name. Set **Write Header Line** to active if there should be an additional header line in the .csv file explaining all the used parameters.

3. Click **OK** to export the antennas.

7.1.6 Import Antennas

Importing antennas is possible with WiMAP-4G. Both, importing antenna information from other projects to the active working set and importing antennas data from other programs that allow exporting data in .csv format is provided.

7.1.6.1 How to Import Antennas

1. Choose **Sites**→**Import Antennas**.

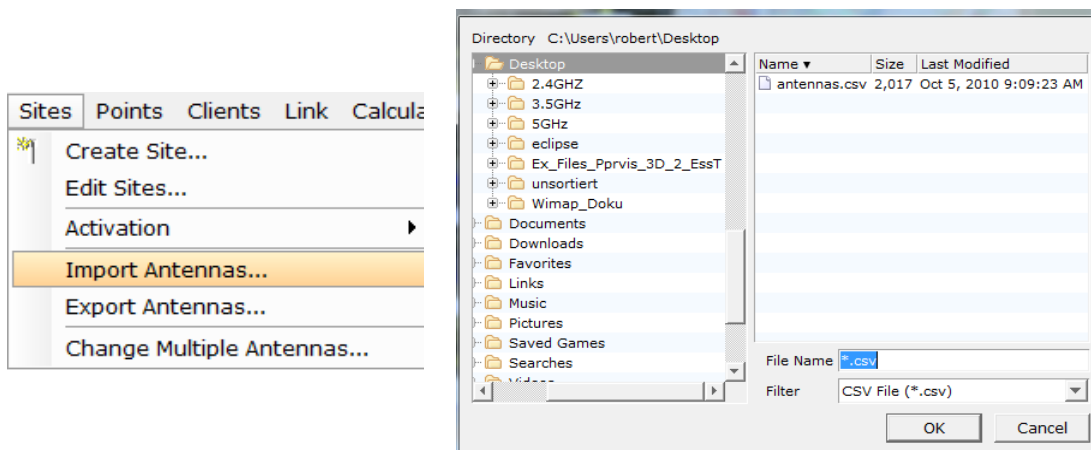


Figure 187: Import antennas

2. Choose a file and click on **OK**. The imported antennas appear on the map:

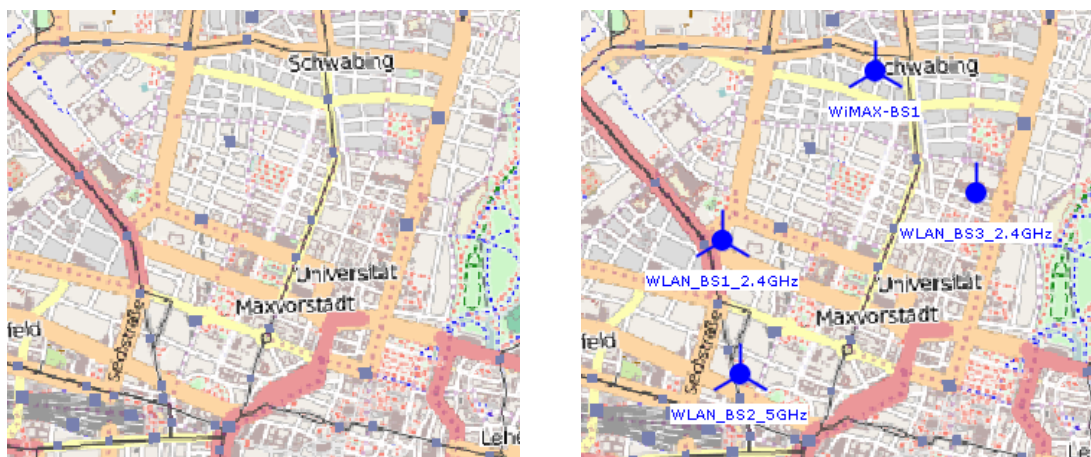


Figure 188: Imported antennas show up on the map with their corresponding sites.

7.1.7 Activate or Deactivate Antennas

Sometimes antennas need to be activated or deactivated, for instance, to make calculations faster. This is important for larger projects.

1. To set antennas active or inactive, open the **sites tab** in the **project explorer**.

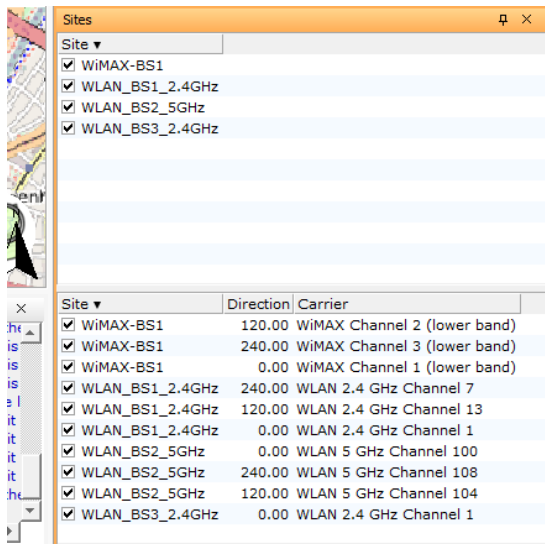


Figure 189: The sites tab

2. At the bottom of the window, all antennas can be activated or deactivated.

7.1.8 The Antenna Set

The antennas are managed in antenna sets therefore it is much easier to edit them in a large project.



7.1.8.1 How to Edit all Antennas Faster

1. Choose **Sites->Change Multiple Antennas**.

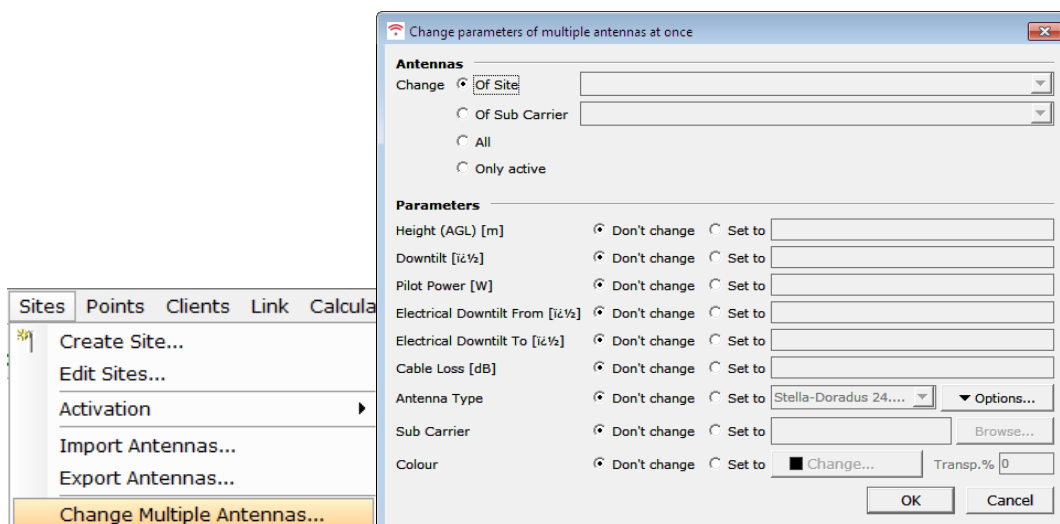


Figure 190: Change all antennas with antenna set change.

2. Choose which specific antennas should be edited (effects antennas of a whole site), or choose all antennas alternatively all active antennas for editing.

3. Choose the desired parameter by changing the option to **Set To** and change the parameter.

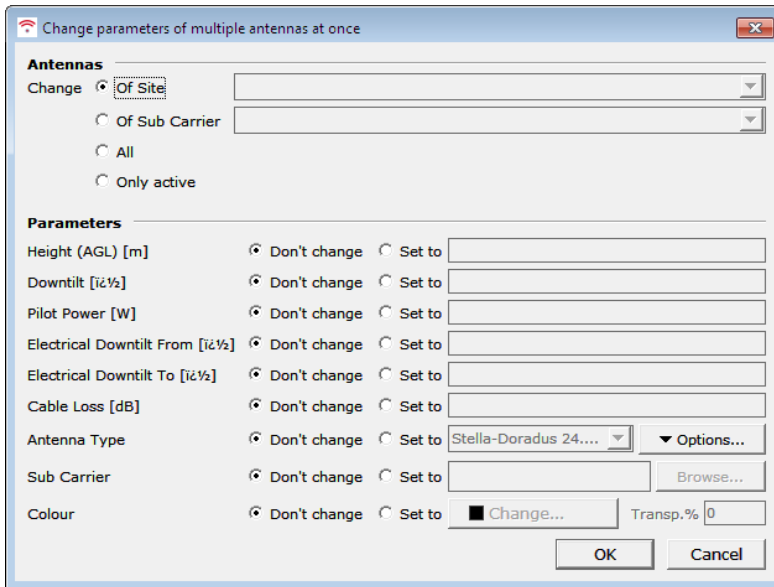


Figure 191: Click OK to save the changes for all antennas.

4. Click on **Ok** to save all changes.



To change only one antenna or site look at 2.6

7.2 Sites

If all antennas are created and/or edited, sites need to make the antennas work in the environment.



7.2.1 How to Create Sites

Creating sites is a main aspect of WiMAP-4G. Antennas should be preconfigured before creating sites.

1. Choose **Sites→Create Site** and choose either **Empty Site** or **Preconfigured Site**. If the preconfigured site was chosen, the carrier and site height can be set.

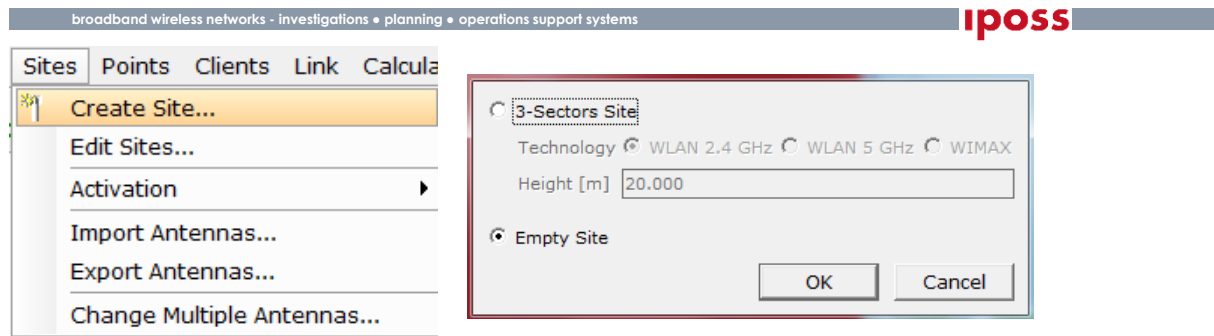


Figure 192: Create empty or 3 sector example sites



A site can also be created with right-clicking the desired point on the map and click on "Create Site".

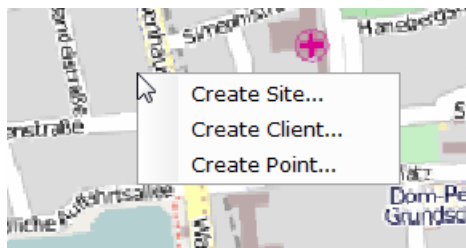


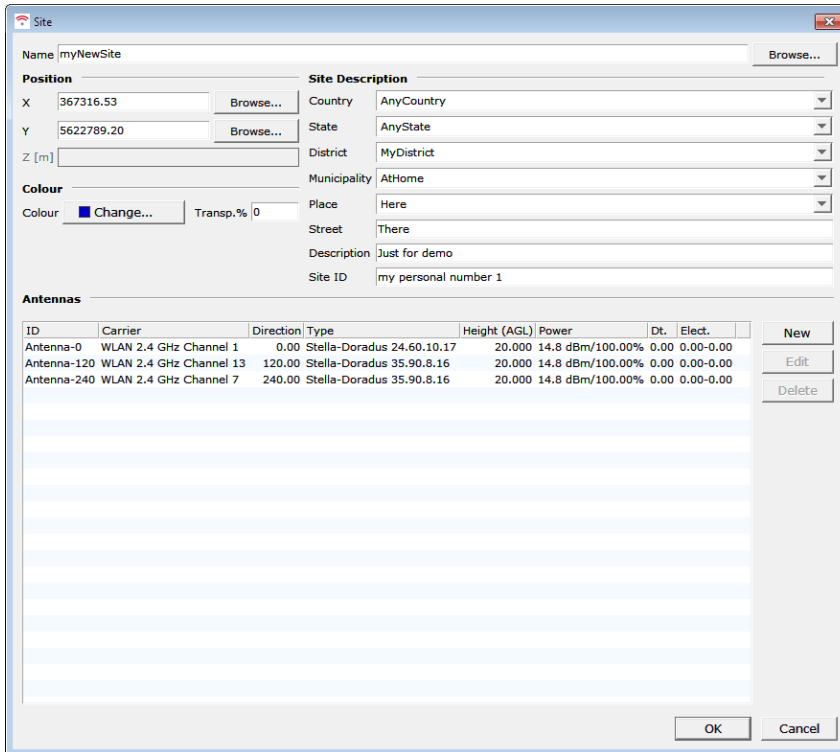
Figure 193: Create a site on the map

If there are no carrier and antennas preconfigured only an empty site can be created. In that case carrier and antennas must be created while creating this site.



To create carriers and antennas see the chapter 6 and 7.1.

2. Choose a name for the new site and type in the correct coordinates where the site should be placed.



Site

Name: myNewSite Browse...

Position

X: 367316.53 Browse...

Y: 5622789.20 Browse...

Z [m]: Browse...

Site Description

Country: AnyCountry

State: AnyState

District: MyDistrict

Municipality: AtHome

Place: Here

Street: There

Description: Just for demo

Site ID: my personal number 1

Antennas

ID	Carrier	Direction	Type	Height (AGL)	Power	Dt.	Elect.
Antenna-0	WLAN 2.4 GHz Channel 1	0.00	Stella-Doradus 24.60.10.17	20.000	14.8 dBm/100.00%	0.00	0.00-0.00
Antenna-120	WLAN 2.4 GHz Channel 13	120.00	Stella-Doradus 35.90.8.16	20.000	14.8 dBm/100.00%	0.00	0.00-0.00
Antenna-240	WLAN 2.4 GHz Channel 7	240.00	Stella-Doradus 35.90.8.16	20.000	14.8 dBm/100.00%	0.00	0.00-0.00

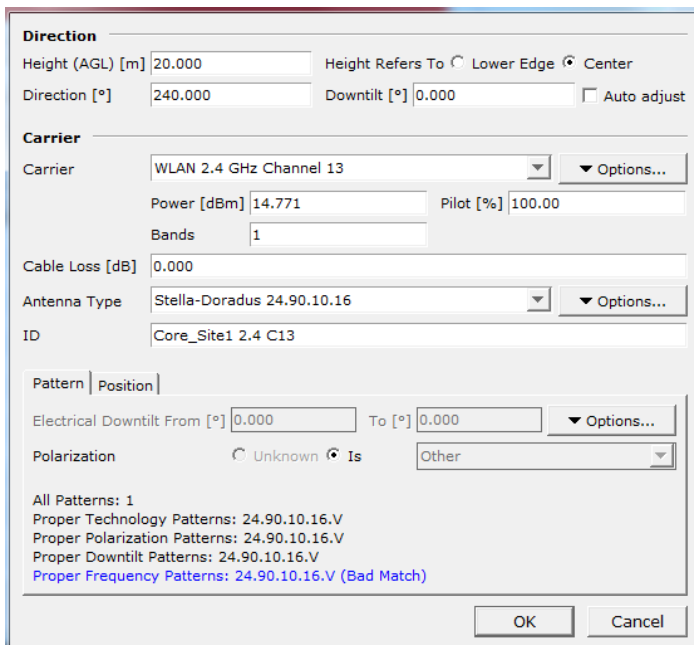
New Edit Delete

OK Cancel

Figure 194: Fill in all fields

A new site has been created, now antennas must be placed to make it work.

3. Choose *New*.



Direction

Height (AGL) [m]: 20.000 Height Refers To: ☐ Lower Edge ☒ Center

Direction [°]: 240.000 Downtilt [°]: 0.000 ☐ Auto adjust

Carrier

Carrier: WLAN 2.4 GHz Channel 13 Options...

Power [dBm]: 14.771 Pilot [%]: 100.00

Bands: 1

Cable Loss [dB]: 0.000

Antenna Type: Stella-Doradus 24.90.10.16 Options...

ID: Core_Site1 2.4 C13

Pattern **Position**

Electrical Downtilt From [°]: 0.000 To [°]: 0.000 Options...

Polarization: ☐ Unknown ☒ Is Other

All Patterns: 1

Proper Technology Patterns: 24.90.10.16.V

Proper Polarization Patterns: 24.90.10.16.V

Proper Downtilt Patterns: 24.90.10.16.V

Proper Frequency Patterns: 24.90.10.16.V (Bad Match)

OK Cancel

Figure 195: Add antennas to the site

- Parameter:

- **Height** (Above ground level): Height of the antenna
- Set **Height Refers To** whether to **Lower Edge** or **Center**. This is important for a hilly environment.
- **Direction**: Direction of the antenna. If the antennas has a 360° angle, the direction does not need to be set to a specific value. Note that signals that use the same channel interfere each other when they overlap.
Value: 0-360°
- **Downtilt**: Set the downtilt of an antenna. This is important for interconnection or hilly environment.
- **Auto-Adjust** can be set to let the program manage the downtilt automatically.
Value: 0-360°
- **Carrier**: Select a carrier for the antenna. If there is not a carrier available for the specific purpose, *create one by clicking on **Options**→**Carriers***.

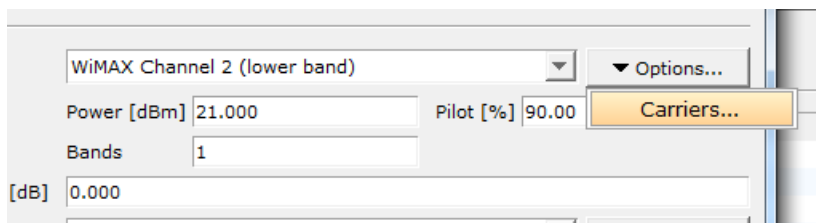


Figure 196: Select a suitable carrier if desired



To create or edit carriers see chapter 6.1.

- **Power (dBm)**: The power of the carrier specified in dBm.



Note that there are limitations according to the power in each country (20 dBm maximum channle power for 2.4 GHz for example).

- **Pilot Power (%)**: The pilot power of the carrier. Affects the signal radius.
Value: 1-100%
- **Cable Loss**: Cable loss for the antennas. The exact value can be obtained from the manufacturer of the antenna.
- **Antenna Type**: Choose the antenna of your choice. Make sure the antenna meets the conditions. A 5.4 GHz antenna may not be used for a 2.4 GHz carrier.

At the bottom of the window is a short list containing four entries. Proper technology pattern is of particular importance. If it is highlighted, the antenna does not achieve the requirements for the current configuration.

All Patterns: 1
 Proper Technology Patterns: 35.60.8.18.V (No Match)
 Proper Polarization Patterns: 35.60.8.18.V

Figure 197: Invalid antenna pattern

Change either **Antenna Type** or **Carrier Type**.

If there is no antenna available for the specific scenario, it can be created by *choosing Option→New or Options→Antenna Types→New.*

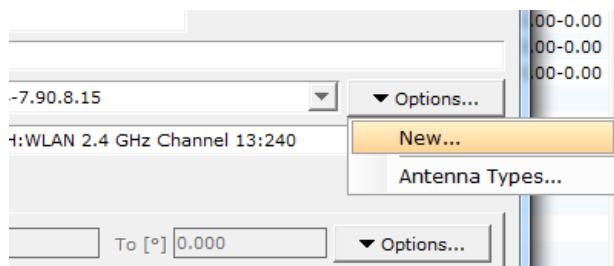


Figure 198: Create new antenna if desired



A short introduction how to create antennas can be found in chapter 7.1.1.1

- **Antenna-ID:** Choose antenna ID. This ID appears in the Project-Explorer and is useful to locate antennas.

There are two more categories at the bottom of the window.

- **Pattern:** There is no need to edit those, because a pattern for the antenna is imported already.
- **Position:** Edit the position of the antenna. If there is no good reason to change this, the antenna should remain in the position of the site.

Click on **Ok** to create and place the antenna at the specific site.

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Position

Name Site 1 Browse...

X 25522.62 Browse... Y 267.87 Browse... Z [m] 1.000

☐ Interconnection

Antennas

ID	Carrier	Direction	Type	Height (AGL)	Power	Dt.	Elect.
Antenna-0	WLAN 2.4 GHz Channel 1	0.00	Stella-Doradus 24.90.10.16	20.000	14.8 dBm/100.00%	0.00	0.00-0.00

New Edit Delete

OK Cancel

Figure 199: The created antenna will appear in the list.

4. If all needed antennas have been created, *click on **Ok** to place the site on the map.*



Figure 200: The created site appear on the map

7.2.2 How to Edit Sites



1. *Right-click the desired site or select the site in the Sites-tab and choose **Edit**.*

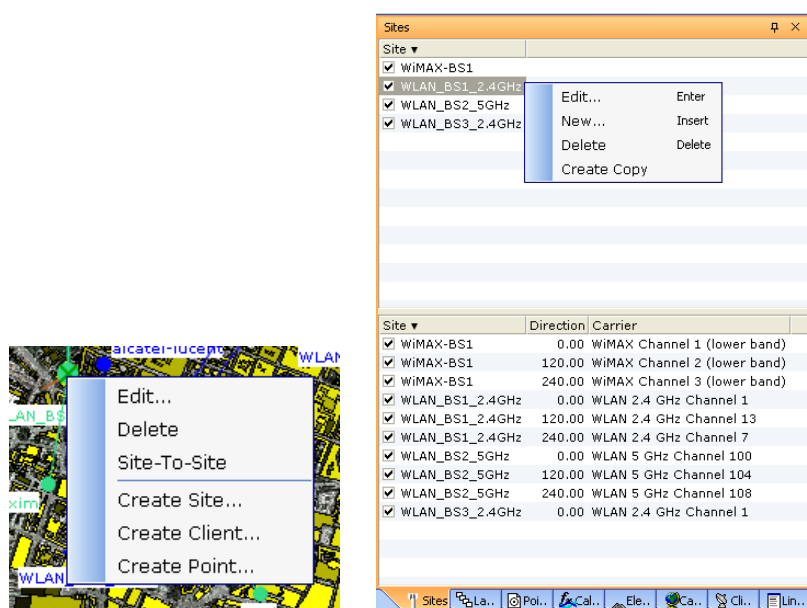
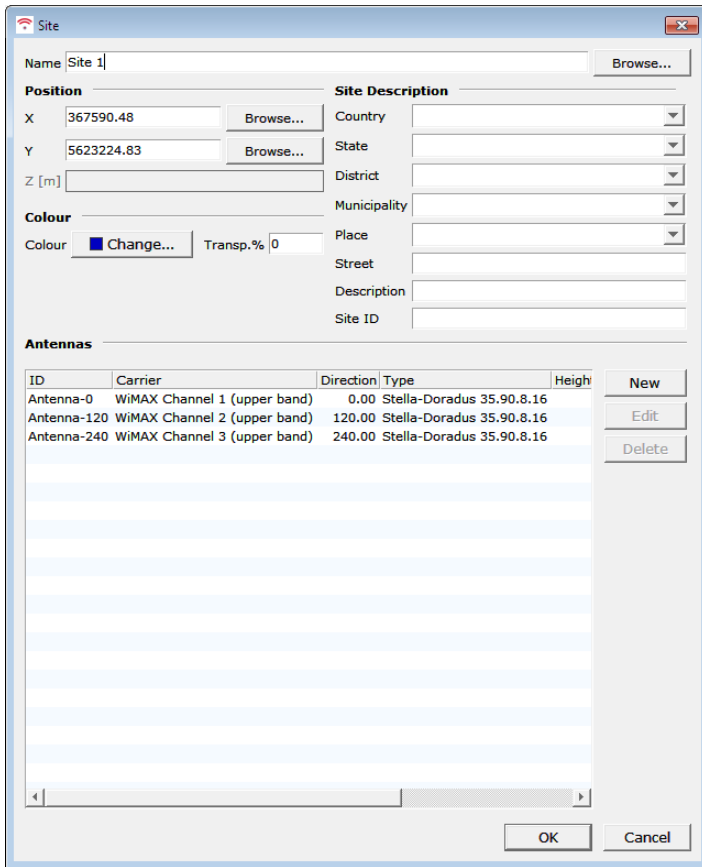


Figure 201: Select the site by Right-click in the map or in the Sites-tab.

2. The sites menu is opened and offering access to site-description and antennas.



ID	Carrier	Direction	Type	Height
Antenna-0	WiMAX Channel 1 (upper band)	0.00	Stella-Doradus	35.90.8.16
Antenna-120	WiMAX Channel 2 (upper band)	120.00	Stella-Doradus	35.90.8.16
Antenna-240	WiMAX Channel 3 (upper band)	240.00	Stella-Doradus	35.90.8.16

Figure 202: Edit the site and click OK to save changes.

3. Antennas can be edited by *choosing the antenna and clicking on **Edit***.



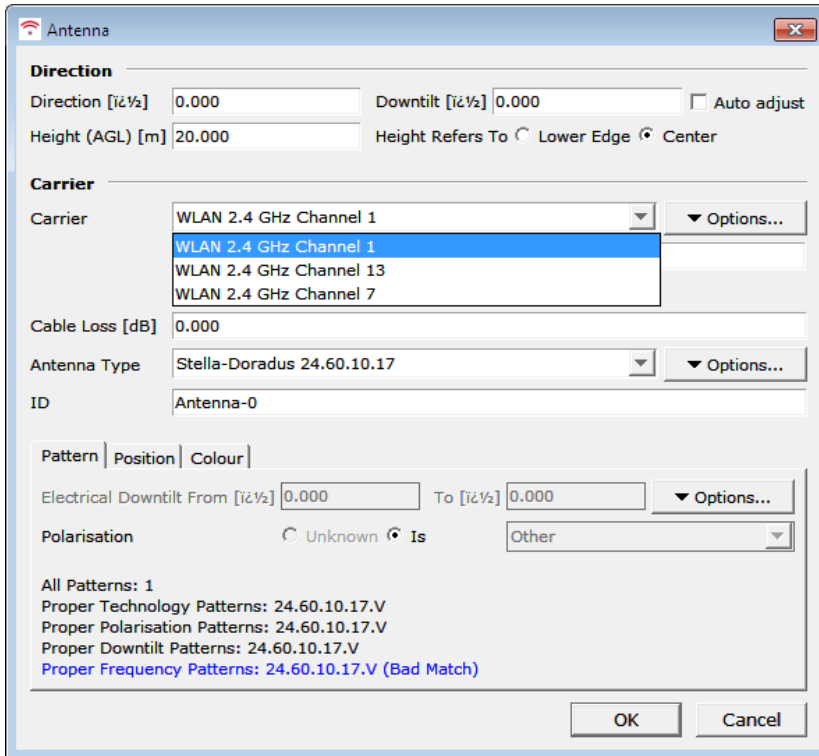
A short introduction how to edit antennas can be found in chapter 7.1.2.1

4. Click on **Ok** to save changes.

7.2.3 How to Change Carrier in a Site

1. Take the same steps like in 7.2.2 and stop by point 3.

2. Choose the antenna to be changed and click on **Edit**.



Antenna

Direction

Direction [i½] 0.000 Downtilt [i½] 0.000 ☐ Auto adjust

Height (AGL) [m] 20.000 Height Refers To ☐ Lower Edge ☒ Center

Carrier

Carrier WLAN 2.4 GHz Channel 1

WLAN 2.4 GHz Channel 1
WLAN 2.4 GHz Channel 13
WLAN 2.4 GHz Channel 7

Cable Loss [dB] 0.000

Antenna Type Stella-Doradus 24.60.10.17

ID Antenna-0

Pattern | **Position** | **Colour**

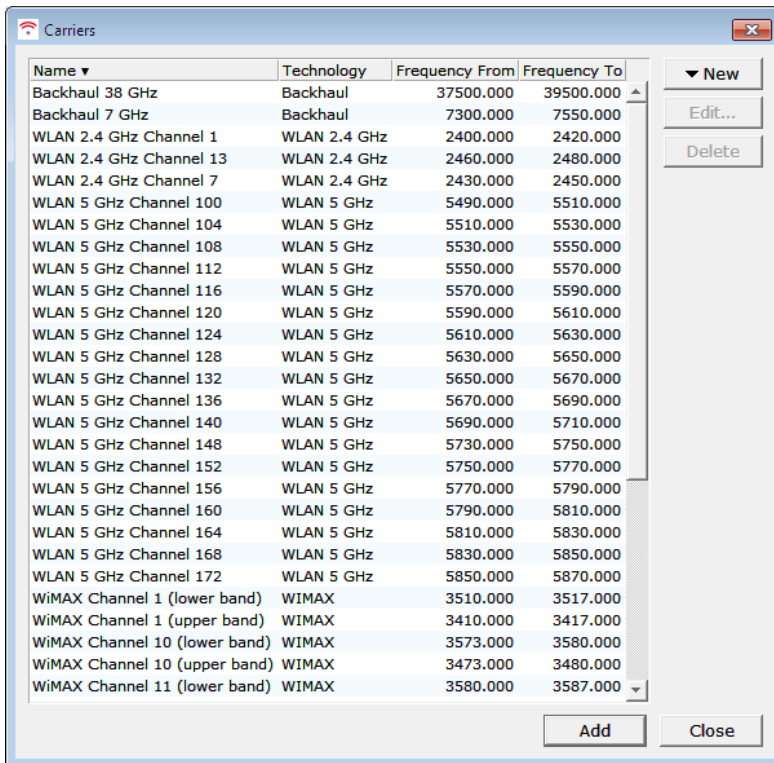
Electrical Downtilt From [i½] 0.000 To [i½] 0.000

Polarisation ☐ Unknown ☒ Is

All Patterns: 1
Proper Technology Patterns: 24.60.10.17.V
Proper Polarisation Patterns: 24.60.10.17.V
Proper Downtilt Patterns: 24.60.10.17.V
Proper Frequency Patterns: 24.60.10.17.V (Bad Match)

Figure 203: Antenna settings in the Site Editor

3. In the drop down menu are only the active carriers of the site, to add another carrier:
Click by Carrier on Options → Carriers.



Carriers

Name ▼	Technology	Frequency From	Frequency To
Backhaul 38 GHz	Backhaul	37500.000	39500.000
Backhaul 7 GHz	Backhaul	7300.000	7550.000
WLAN 2.4 GHz Channel 1	WLAN 2.4 GHz	2400.000	2420.000
WLAN 2.4 GHz Channel 13	WLAN 2.4 GHz	2460.000	2480.000
WLAN 2.4 GHz Channel 7	WLAN 2.4 GHz	2430.000	2450.000
WLAN 5 GHz Channel 100	WLAN 5 GHz	5490.000	5510.000
WLAN 5 GHz Channel 104	WLAN 5 GHz	5510.000	5530.000
WLAN 5 GHz Channel 108	WLAN 5 GHz	5530.000	5550.000
WLAN 5 GHz Channel 112	WLAN 5 GHz	5550.000	5570.000
WLAN 5 GHz Channel 116	WLAN 5 GHz	5570.000	5590.000
WLAN 5 GHz Channel 120	WLAN 5 GHz	5590.000	5610.000
WLAN 5 GHz Channel 124	WLAN 5 GHz	5610.000	5630.000
WLAN 5 GHz Channel 128	WLAN 5 GHz	5630.000	5650.000
WLAN 5 GHz Channel 132	WLAN 5 GHz	5650.000	5670.000
WLAN 5 GHz Channel 136	WLAN 5 GHz	5670.000	5690.000
WLAN 5 GHz Channel 140	WLAN 5 GHz	5690.000	5710.000
WLAN 5 GHz Channel 148	WLAN 5 GHz	5730.000	5750.000
WLAN 5 GHz Channel 152	WLAN 5 GHz	5750.000	5770.000
WLAN 5 GHz Channel 156	WLAN 5 GHz	5770.000	5790.000
WLAN 5 GHz Channel 160	WLAN 5 GHz	5790.000	5810.000
WLAN 5 GHz Channel 164	WLAN 5 GHz	5810.000	5830.000
WLAN 5 GHz Channel 168	WLAN 5 GHz	5830.000	5850.000
WLAN 5 GHz Channel 172	WLAN 5 GHz	5850.000	5870.000
WiMAX Channel 1 (lower band)	WIMAX	3510.000	3517.000
WiMAX Channel 1 (upper band)	WIMAX	3410.000	3417.000
WiMAX Channel 10 (lower band)	WIMAX	3573.000	3580.000
WiMAX Channel 10 (upper band)	WIMAX	3473.000	3480.000
WiMAX Channel 11 (lower band)	WIMAX	3580.000	3587.000

Figure 204: Carrier list

4. Select the carrier for the antenna and click on *Add* , for example the **WLAN 5 GHz Channel 112**.

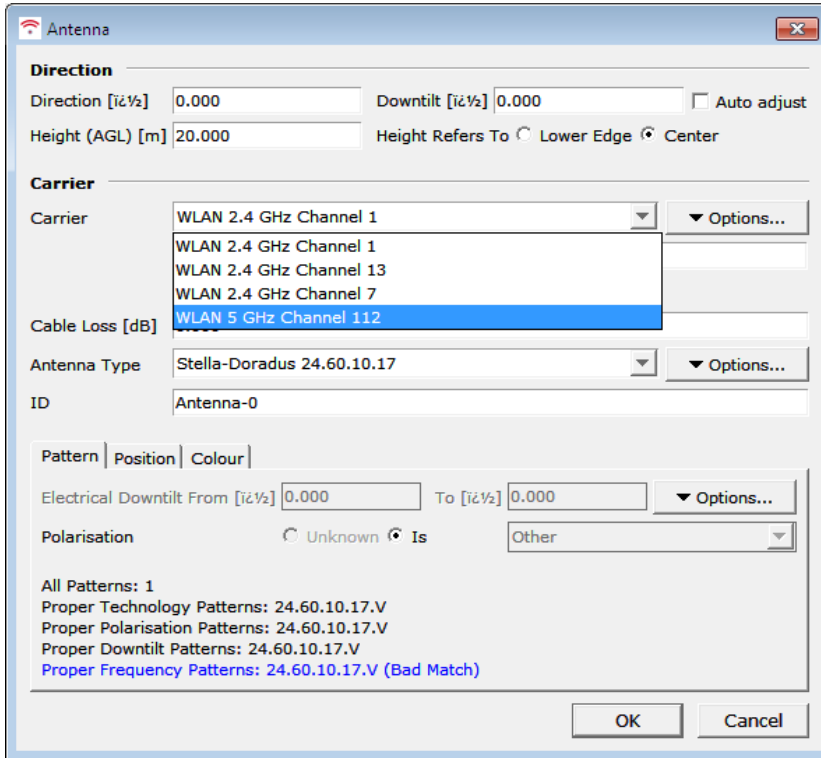


Figure 205: Antenna settings in Site Editor after add another Carrier

5. Select now the added carrier whether the “new” carrier match to antenna type can be seen in the **Pattern** tab.

7.2.4 Activate or Deactivate Sites

Sites can be activated or deactivated. This may be important if the user wants to make a calculation that does not include all antennas, which can be a great many. A lot of antennas need a long time to calculate and if only a little detail has been changed, the user would not want to make a two hour calculation to see the mistake. There are two methods to activate or deactivate sites.



7.2.4.1 How to Activate or Deactivate all Sites at Once

1. Choose **Sites→Activation→Activate All** or **Deactivate All**.

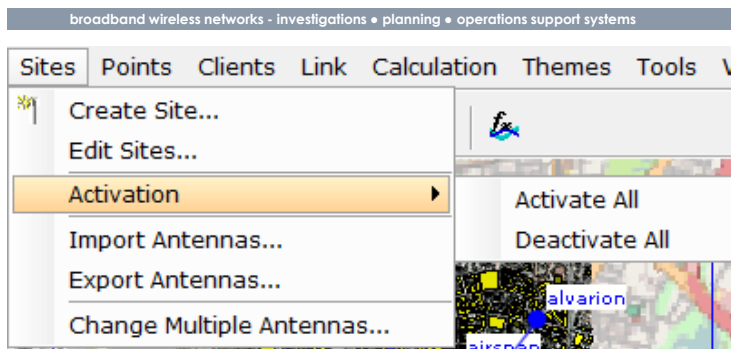


Figure 206: Activate or deactivate all sites

This option could be useful if a calculation needs to be done only with a few sites whereat a lot of sites need to be deactivated.

*Simply choose **Deactivate All** and activate manually the few sites needed. By the time a calculation is done, all sites can be activated with **Activate All**.*



7.2.4.2 How to Activate or Deactivate Sites Manually

1. To manually set sites active or inactive *simply open the **Sites Tab** in the **Project-Explorer**.*

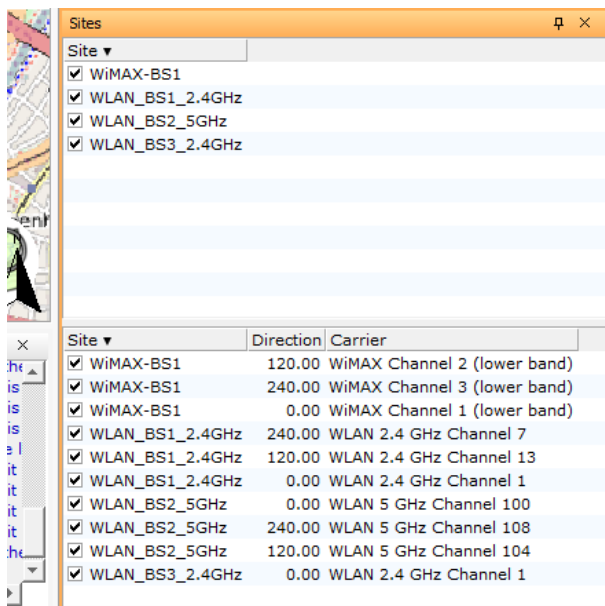


Figure 207: The sites tab

2. All sites are listed at the top of the tab. They can be activated or deactivated.

8 Points

Points have a lot in common with clients but they are a little bit different. Points can be placed everywhere on the map. They represent for example potential customers or measurement points for the wireless solution created with WiMAP-4G. There are less calculation possibilities for points than for carriers. A point should be set if there is no further information on a client about what technique he uses.

8.1 Measurement Points

A measurement point is defined by coordinates and other parameters like *Power Level* or *SNR*. This used measurement point is for radiowave measurement like WLAN or WiMAX. The category *Measurement* is an example for a point category that can be used to define a measurement point. Measurement points can be imported from a measurement data file in .csv format, see Figure 208 for an example. Each point must have a minimum of attributes like *Name* and *Coordinates*.



If no suitable converter is available, contact us at info@brown-iposs.eu.

Measurement_48u3.csv									
	Name	Power	SNR	Carrier	Height	X	Y	Z	Colour
1	p01_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
2	p02_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
3	p03_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
4	p04_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
5	p05_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
6	p06_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
7	p07_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
8	p08_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
9	p09_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
10	p10_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
11	p11_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
12	p12_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
13	p13_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
14	p14_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
15	p15_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
16	p16_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
17	p17_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		
18	p17_SID105_AP1	-86	8	WLAN_5GHz		6.776615	51.21928667		

Figure 208: Supported .csv file with measurement information

A measurement file can be imported by a normal import of points (look at 8.5.3). But there is a little difference. Each measurement point get their own point, so that one point can overlap another points. After an import it should be checked if the imported carrier is existing. If this carrier does not exist, the carrier must be created. With the function **Points→Edit multiple...** (look at 8.3.3) it is also possible to change the carrier to an available carrier.

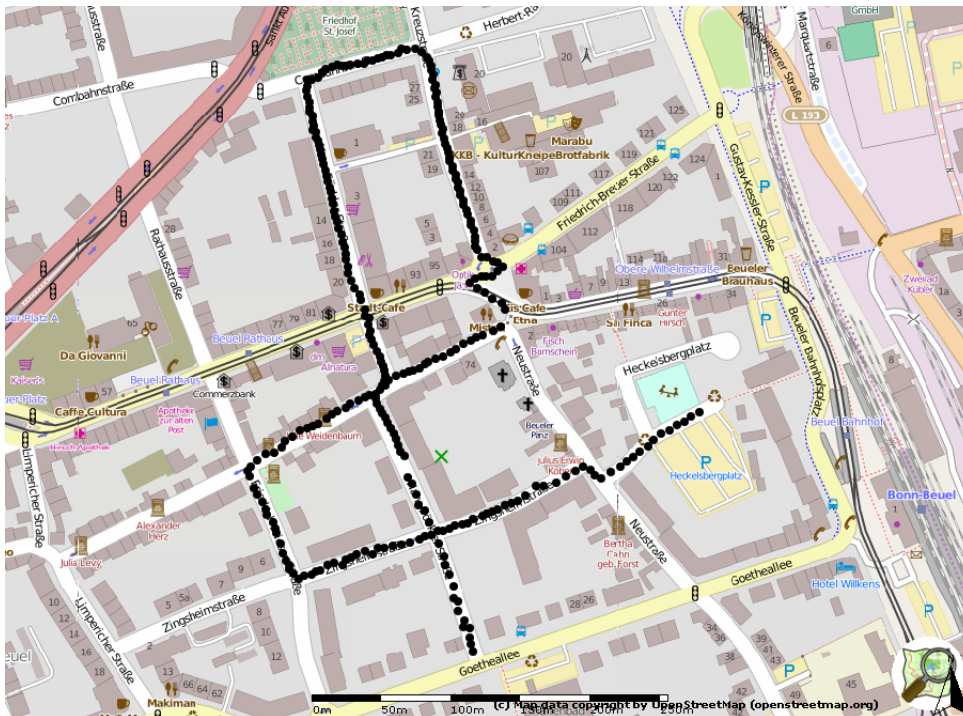


Figure 209: Measurement points from a measurement without colour information

If there is no colour information in the .csv file all points are black. So the colour can be set by the functions coverage and/or visualisation (look at 8.6.2 and 8.6.3).

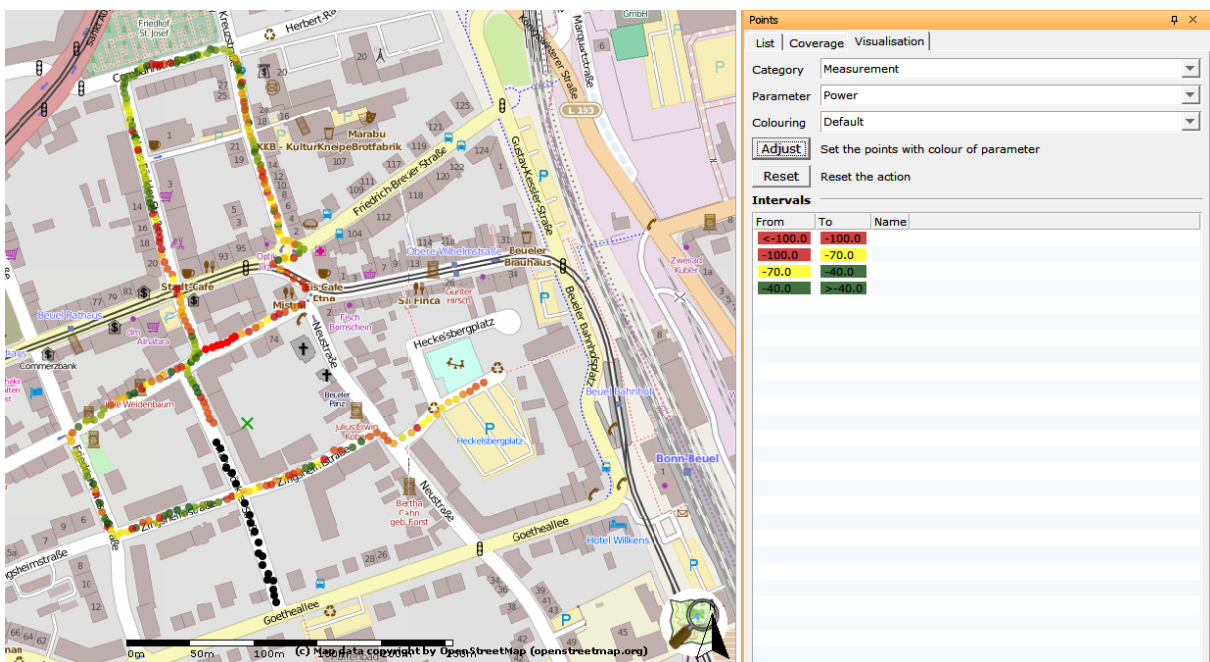


Figure 210: Measurement points from a measurement coloured by visualisation

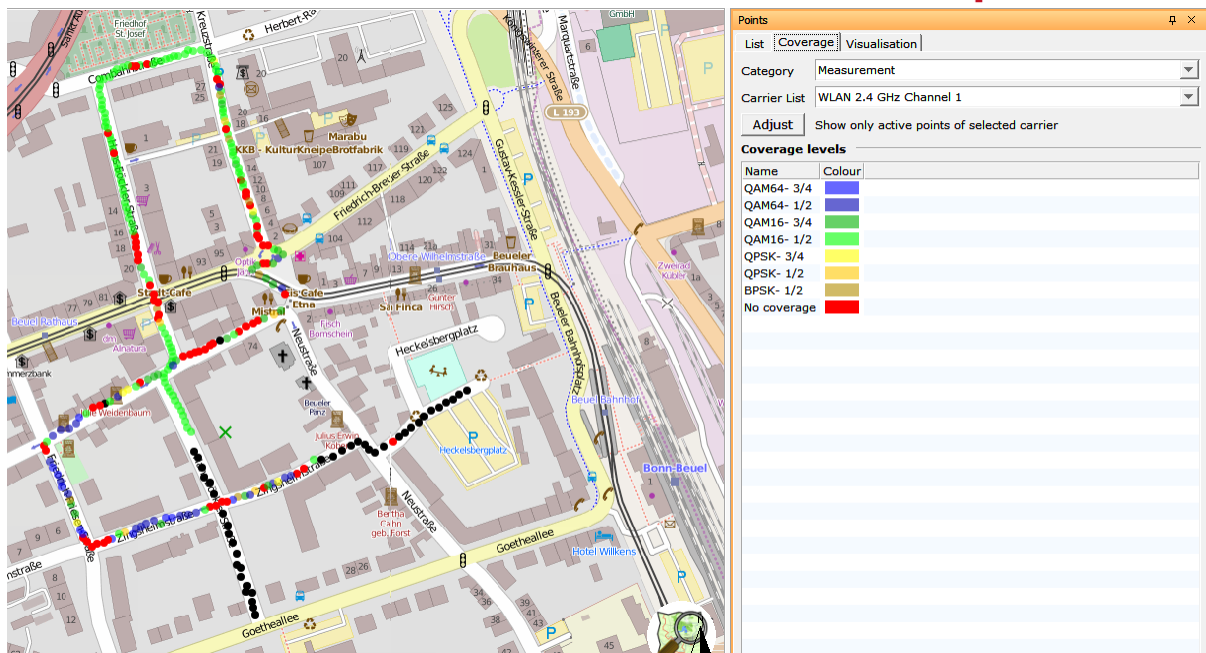


Figure 211: Measurement points from a measurement coloured by coverage

8.2 Point Categories

Point categories are essential to create points. Before creating a point on the map, the point category needs to be created or edited for specific needs. Add all columns that can be described while a point is created. If the height of the customer antenna is known, *add a column of type **Meter** and name it **Height*** for example.

All category parameter types that can be added:

- C/I
- Data rate
- Degree
- Field strength
- Meter
- Ordinal
- Power level
- Text
- URL
- X-coordinate
- Y-coordinate

The default category *Measurement* is a category that has the following default parameter: *Power Level, SNR, Carrier and Height*. But the parameter can be extended with e.g. Field Strength, Data rate and more.

The demo project "Munich" has the category *Potential Customer* with the parameters Height and Y/N (Text). This category can be added also to other projects by importing it from the demo project or by defining it manually.



8.2.1 How to Edit Point Categories

If a new value type for a point is necessary, the point category needs to be edited first.

1. Choose *Points*→*Edit Categories*.

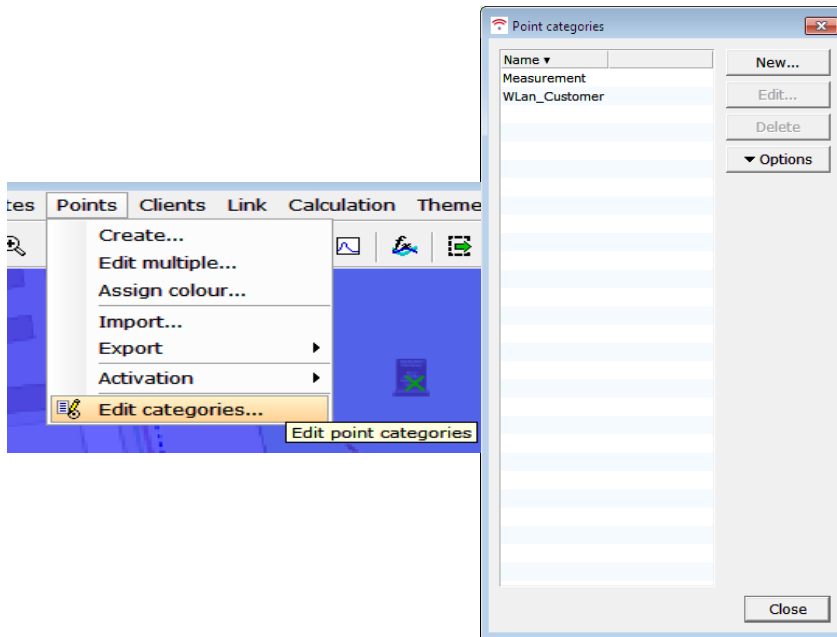


Figure 212: Edit point categories

2. Choose the category that needs to be edited and click on **Edit**. The point category window opens and columns can be added, edited, deleted or moved up and down. When all changes are done, click on **Ok** to save the changes.

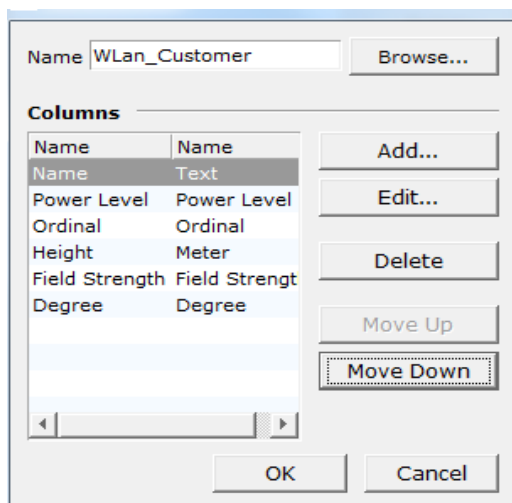


Figure 213: Click on OK to save the changes.



8.2.2 How to Create a Point Category

1. Choose **Points**→**Edit Categories**.

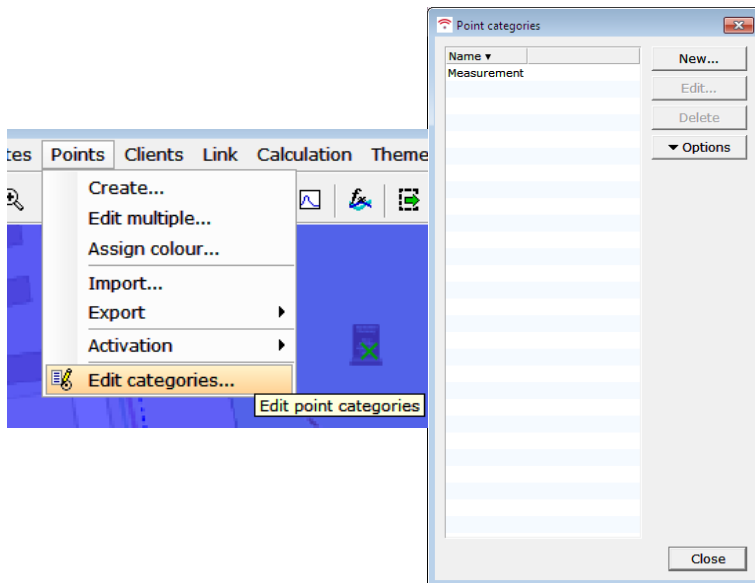


Figure 214: Create new point categories

2. There are two preconfigured point categories, so either use them, edit them or create a new one. To create a new point category, *click on **New***.

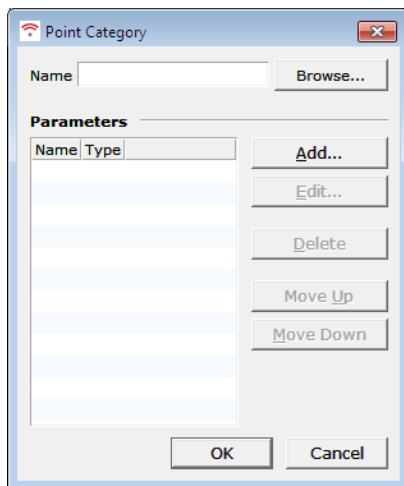


Figure 215: Fill in a name

3. Choose a name for the point and click on **Add** to create new columns for this point.

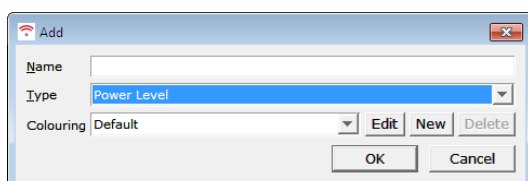


Figure 216: Choose a type and name.

In case there are no special circumstances, it is recommended to choose the type as the name.

Add all desired columns and press **OK** to save the point category.

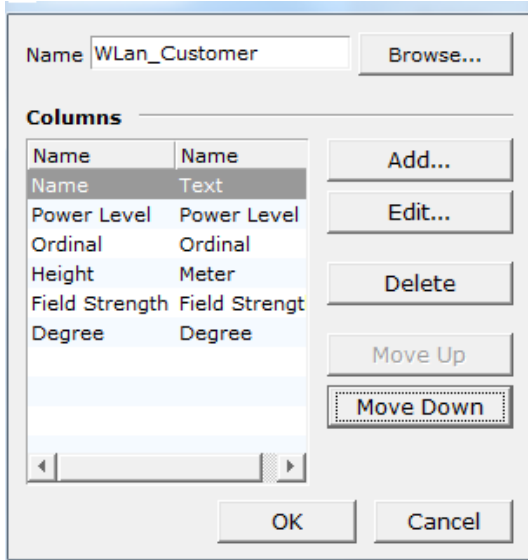


Figure 217: Click OK to save the new category.

8.3 Create Points

When all point categories needed are created, a point can be set.



8.3.1 How to Create Points

1. There are three possibilities to create points:

- Choose **Points→Create**.

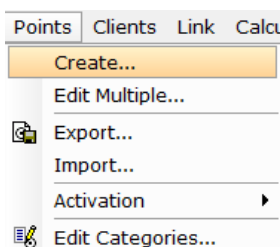


Figure 218: Create points from the menu

- Right-click the desired position on the map and choose **Create Point**.

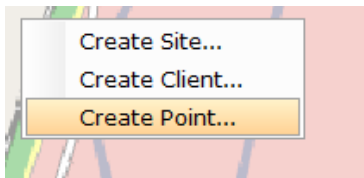


Figure 219: Create points on the map

- Choose the **point tab** in the **Project-Explorer**, right-click there and choose **New**.



Figure 220: Create points in the points tab

2. In the appearing window choose a point category and click on **OK**.

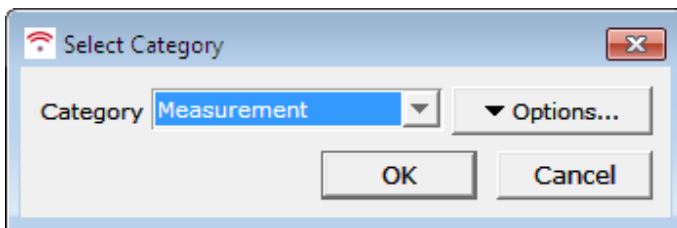


Figure 221: Choose a category

If there is no point category, it needs to be created. This can be done by *choosing Options→New*.



A short introduction how to create point categories can be found in chapter 9.1.1

3. The next window shows all the columns created in the chosen point category. Feel free to fill as many as you can. The X/Y coordinates can be manually set to make sure the point position hit the actual position of the customer exactly. If the coordinates are only known from a different coordinate system, press **Browse** to set them correctly.

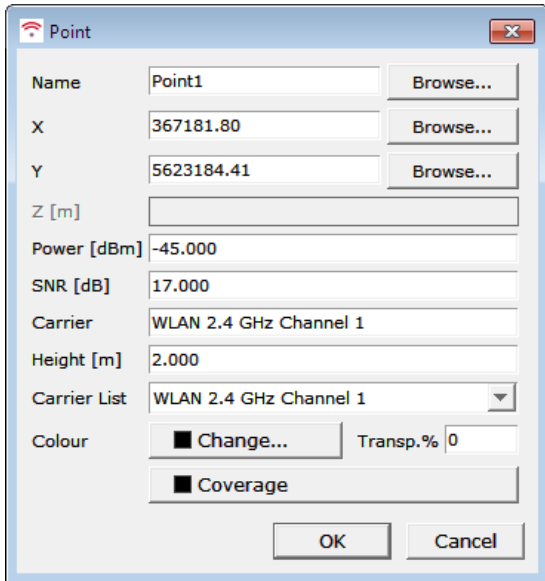


Figure 222: Fill in all fields.

If everything is done, *press **Ok** to create the point.*



Figure 223: The new point appears on the map.



8.3.2 How to Edit Single Points

Sometimes points need to be edited because there may be more information about the customer available. If this edit includes a new type of value, edit the point category first and edit the point afterwards.

1. There are two possibilities to single edit a point:

- *Right-click on the point on the map and choose **Edit**.*

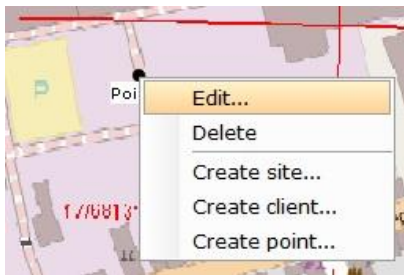


Figure 224: Edit point via right-click on the map

- *Right-click on the point in the Project-Explorer and click on **Edit**.*

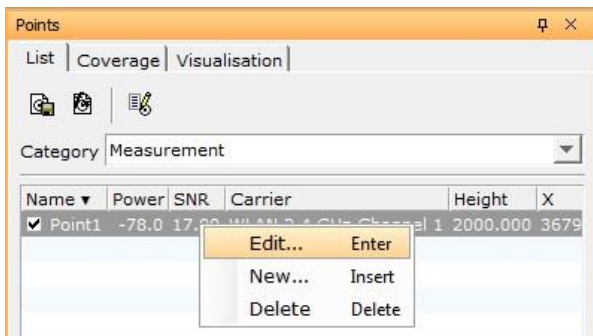


Figure 225: Edit point with the help of the points tab

The points in the point tab are shown by category. The right point category needs to be chosen to show the desired point in the list.

2. In the appearing window, *edit the columns of the point and click on **OK** to save the changes.*

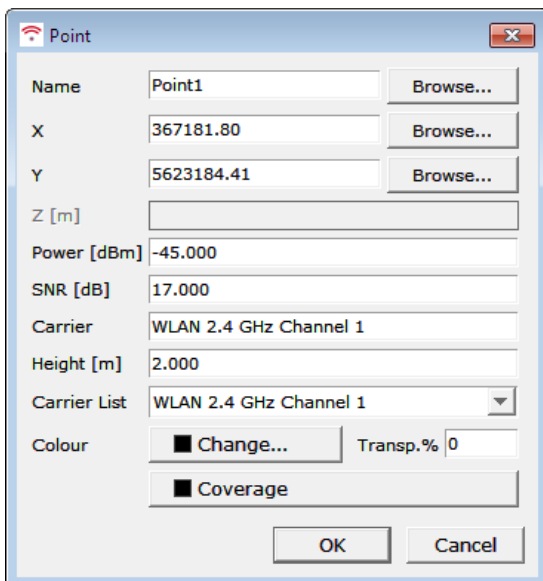


Figure 226: Edit the desired fields



8.3.3 How to Edit Multiple Points

Points can also be edited in groups, which means that a value can be set for all members of a point category. This could be very useful if a value of a whole group changed, for example, the power level.

1. Choose **Points**→**Edit Multiple**.

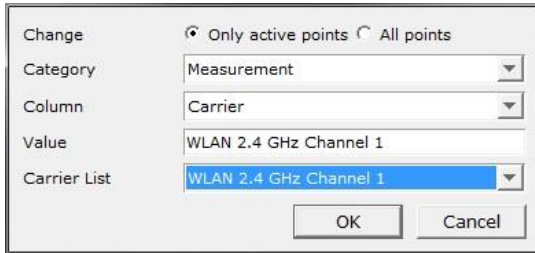


Figure 227: Edit multiple points at once

2. Choose the desired point category and choose either all points to be edited or only active points. Choose a column that should be edited for all members of the point category and insert a new value. Click on **OK** to save the changes.

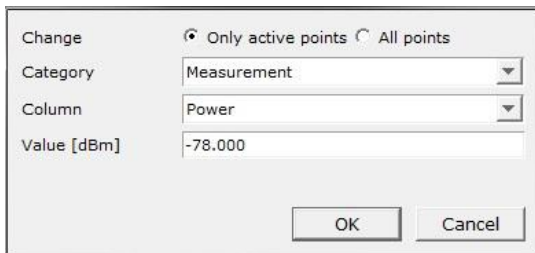


Figure 228: Choose column and value

8.4 Point Activation

Points can be active or inactive as well as antennas, sites and clients. This can be beneficial, for example, for making a calculation.



8.4.1 How to Activate or Deactivate Points

Points can be activated or deactivated in different ways, depending on the user.

Fast way:

1. Choose **Points→Activation** and one of the options:

- **Activate all:** All points of a chosen point category will be set to active.
- **Deactivate all:** All points of a chosen point category will be set to inactive.
- **Invert activation:** All active points will be inactivated and all inactive will be activated (point category needs to be chosen).
- **Rectangular activation:** After choosing a point category, the four vertices of a rectangle can be altered to coordinates and all points inside will be activated.
- **Circular activation:** After choosing a point category, both center coordinate and radius can be set and all points inside the circle will be activated.
- **Filter activation:** Points can be activate based on a filter with the following parameters: Power Level, SNR and Carrier.

Slow but precise way:

2. All points of the specific category are shown in the **point tab** of the **Project-Explorer**. They can be activated or deactivated by checking or unchecking them.

Category WLAN_Customer								
Name	Name ▼	Power Level	Ordinal	Height	Field Strength	Degree	X	Y
☐	test						639701.87	5339210.
☒	Peters Peters	-Inf		8.000		20.00	637578.10	5338677.

Figure 229: The points tab

8.5 Export and Import Points

Points can be imported and exported. This could be useful if these points are used in other projects or if there were other projects with a lot of already constructed points. It is not necessary to create them twice. Furthermore it is necessary to import or to export the measurement data.



8.5.1 How to Export Points

1. Choose **Points**→**Export**→**Data....** to open the export window.

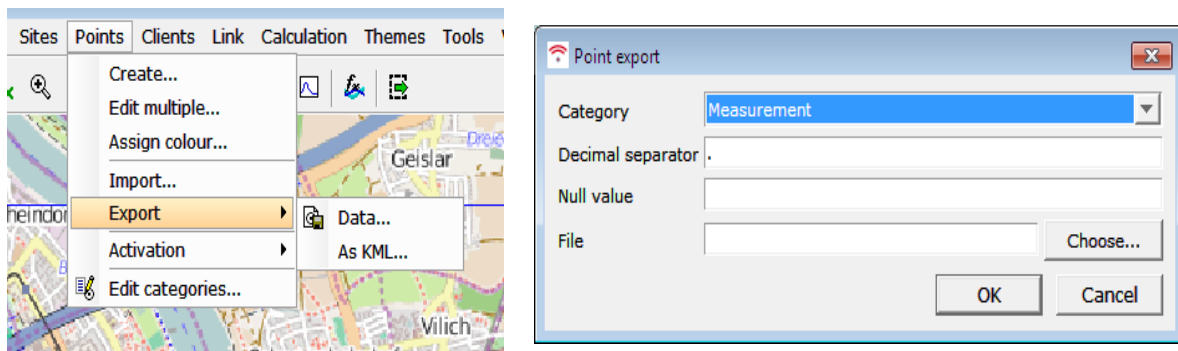


Figure 230: Export points

2. Choose the **point category** that should be exported and set a **decimal separator**. This decimal separator is used in the created file to separate numbers. The null value will be used for lacking point columns and hence is only useful to convey readability of the created .csv file.



Note that not all symbols are supported. An unsupported symbol prevents the user from importing a .csv-file to another project. It is always secure to choose "999".

3. Choose a filename and path for the created file. If the file path of the file is unknown, click on **Choose** to open the explorer browser window. If everything is done, click on **OK** to export all points of that **Point Category**.

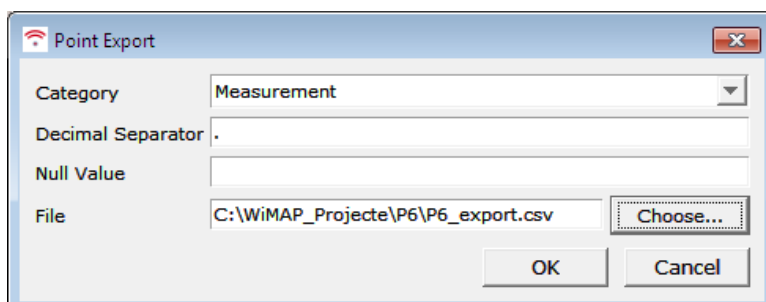


Figure 231: Fill in all fields

4. The created .csv file can be found at the chosen file path.

8.5.2 How to Export Points as .kml file

1. Choose **Points→Export→As KML** to open the export window.

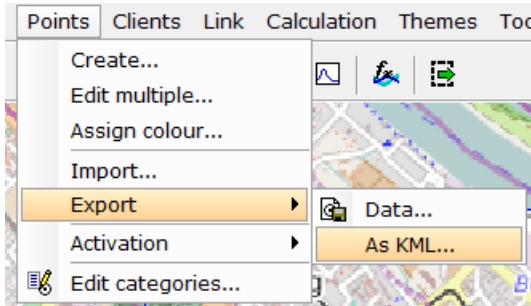


Figure 232: Export points as .kml file

2. Select the path where the .kml file should be save.

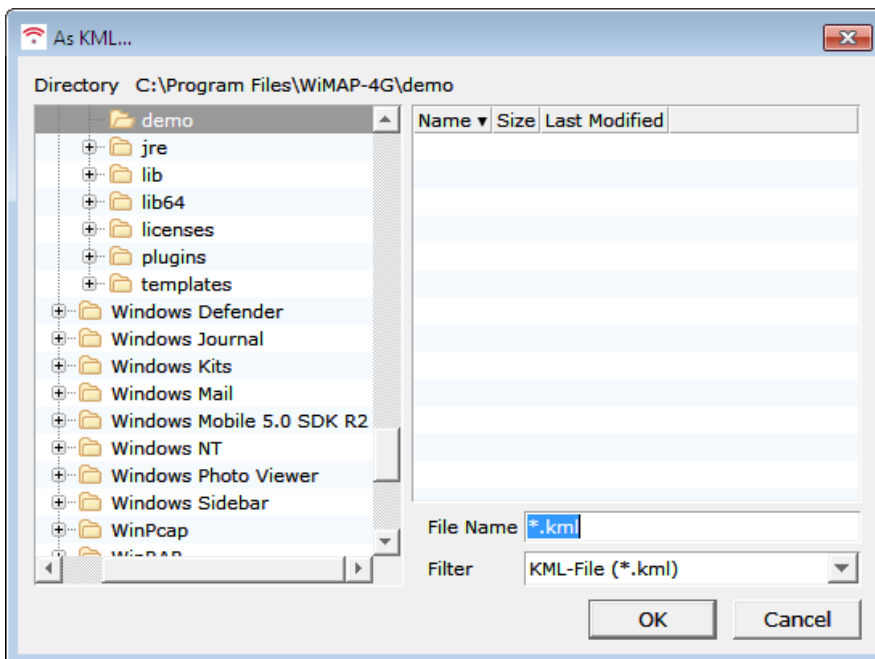


Figure 233: Select path for export as .kml file

The export of points is finished and the .kml file can be used in other programs like Google Earth.

8.5.3 How to Import Points



1. Choose **Points→Import** to open the import window.

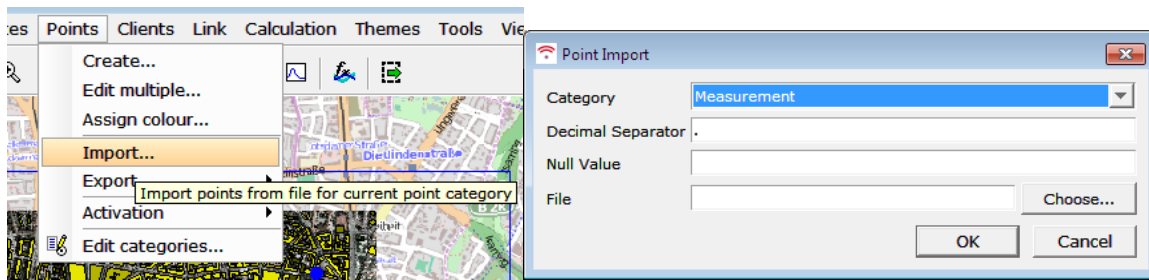


Figure 234: Import points

2. Choose a **point category** which contains the imported points in the actual project.



The point category does not matter to the import of the points, but the actual point category needs to have the same point columns used by the exported points.

The decimal separator should not be edited. The null value can be edited to set columns to a specific value with none exported value.

Choose the file and click on **OK** to import the points.

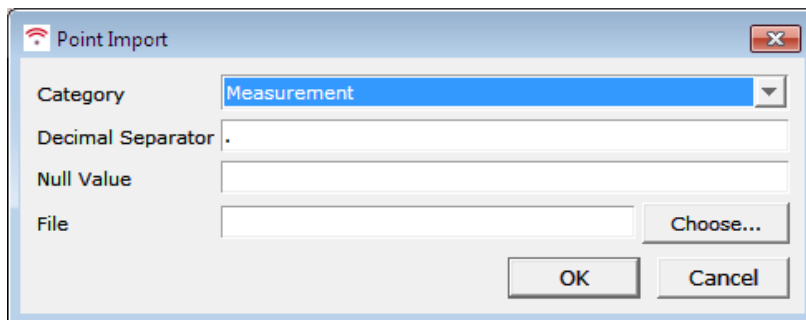


Figure 235: Fill in all fields

3. The imported points are shown on the map now.

8.6 Points colour assignment

The colour of a point can be changed manually for a better overview. With the functions visualisation and coverage the colour can be set based on a parameter, for example *Power*, *SNR* or *Coverage*.



8.6.1 How to change the colour of a point manually

1. Open the edit-window of a point like described in 8.3.2 for edit a single point or open the menu **Point→Assign colour** to edit multiple points.

2. Select **Colour→Change...** for editing a single point (left), for editing multiple points (right), select **Colour→Change manually** and click on **Change....** Now a window with a colour palette will be open.

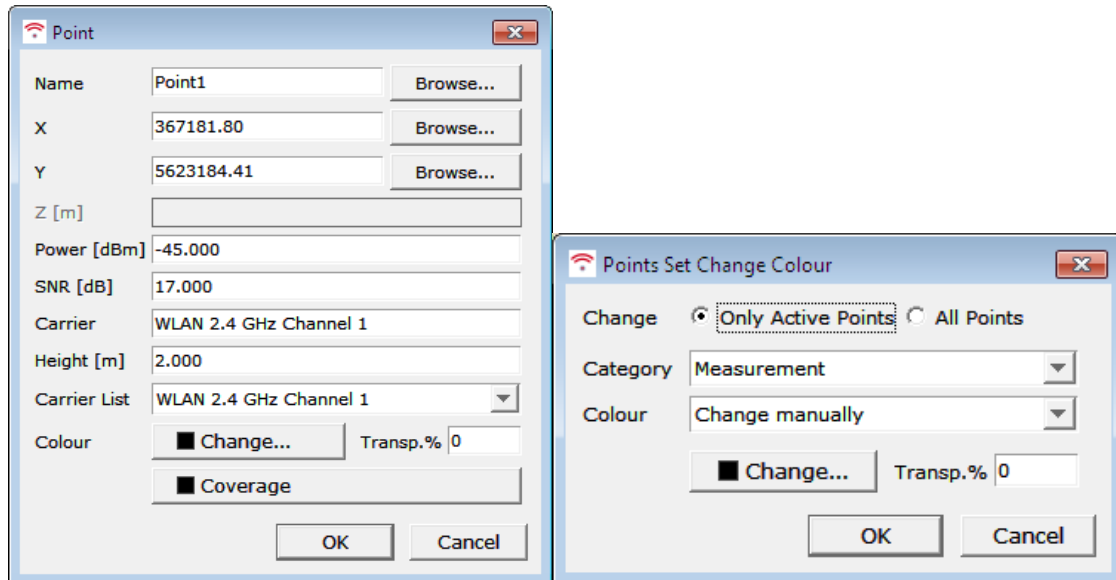


Figure 236: left: Edit single point | right: Edit multiple points

3. Click on **OK** to close the colour palette to apply the selected colour and click on **OK** again to close and apply the settings in the edit window.

8.6.2 Change colour of points temporary by visualisation tab

The *Visualisation tab* changes the colour of points based on the category, parameter and the colouring. In this tab only those parameter can be selected which have colour as a trait.



The colouring of a parameter can be set at *Edit categories→Edit a selected category→Edit a selected Parameter→Colouring→Edit or New.*

8.6.3 Change colour of points by coverage tab

For colouring with the coverage each point must be activated for this function. This works by editing a point (*Edit→Colour→Coverage*) or by activating multiple points by *Points→Assign colour→Colour→Adopt with coverage* (like in figure 230). In the points tab coverage can show the colour levels.

8.7 Clients and Points

It is possible to convert clients to points or to create clients from points. This can be used if the user does not want clients on his project anymore and wants to convert them to simple

points. This can also be a benefit for the overview. As mentioned, there is a small area with about 100 clients. For a better overview it is necessary to convert the clients temporary otherwise all associated lines would simply flood the screen. The other way is to convert points to clients in a future stage of the project.



8.7.1 How to Create Clients from Points

1. Choose **Clients→Convert from Points**.

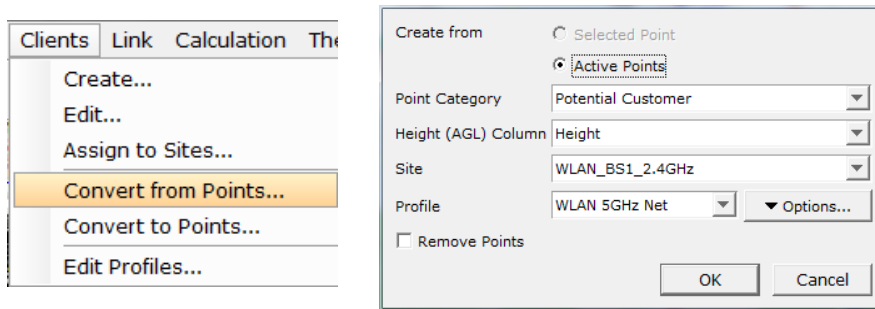


Figure 237: Convert points to clients

2. Now, there are a few settings that need to be done to create a client from a point. At first, it should be decided whether a selected point or all active points should be converted. *To use the first option, select a point in the point tab of the Project-Explorer before choosing **Client→Convert from Points**.*

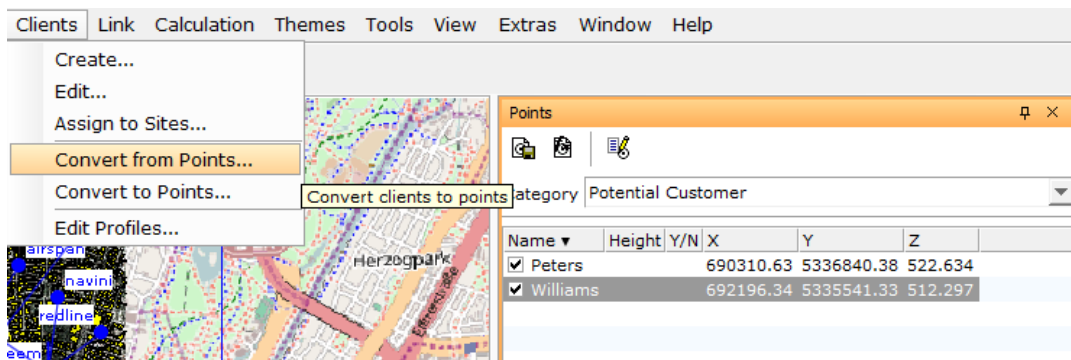


Figure 238: Mark a point in the points tab in the Project-Explorer

If **Selected Point** was chosen, the point category setting will turn to grey and therewith not editable. If **Active Points** was chosen, a point category can be selected for converting its points. Next thing to choose is the height column from the chosen point category. So if there are a few columns from type "meter", *choose the one that describes the height above ground level*. Afterwards, choose a profile and a site, which should be used by the created clients. Feel free to edit or create new profiles by clicking on **Options→New** or **Options→Client Profiles**. Before finishing the conversion, choose the points to be deleted after creating the clients or to still occur afterwards.

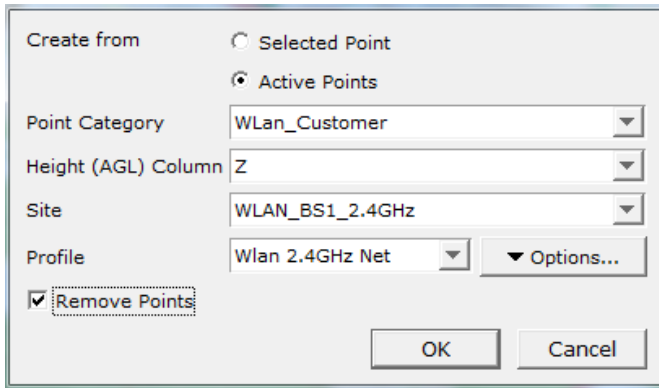


Figure 239: Fill in all fields and click OK to start the conversion

3. Click on **OK** to convert all the chosen points to clients.

If everything worked out, the points will be clients and will show a blue dashed line in the chosen site.

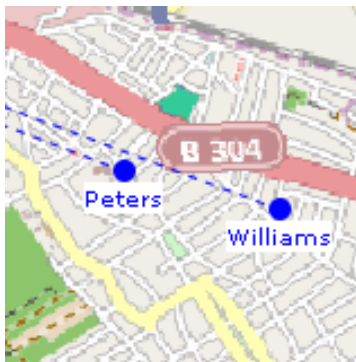


Figure 240: The created clients appear on the map



8.7.2 How to Convert Clients to Points

1. Choose **Clients→Convert to Points**.

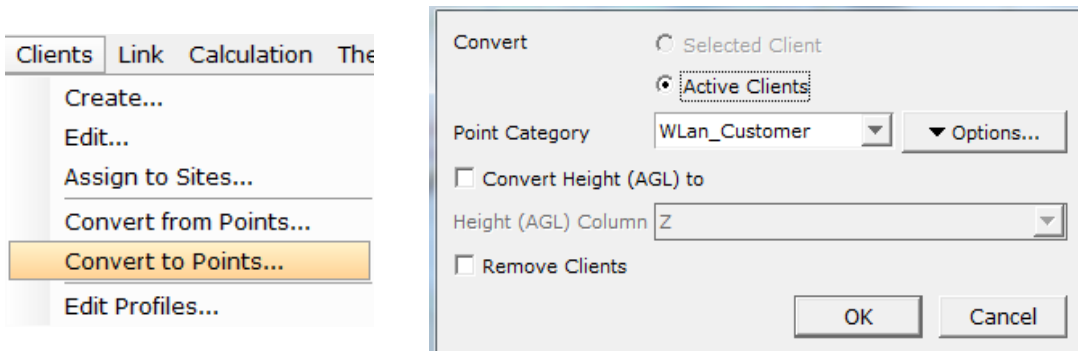


Figure 241: Convert clients to points

2. At first it need to be decided whether a selected client or all active clients should be converted. To use the first option, a client need to be selected in the **Project-Explorer** in the **Client Tab** before choosing **Client→Convert to Points**.

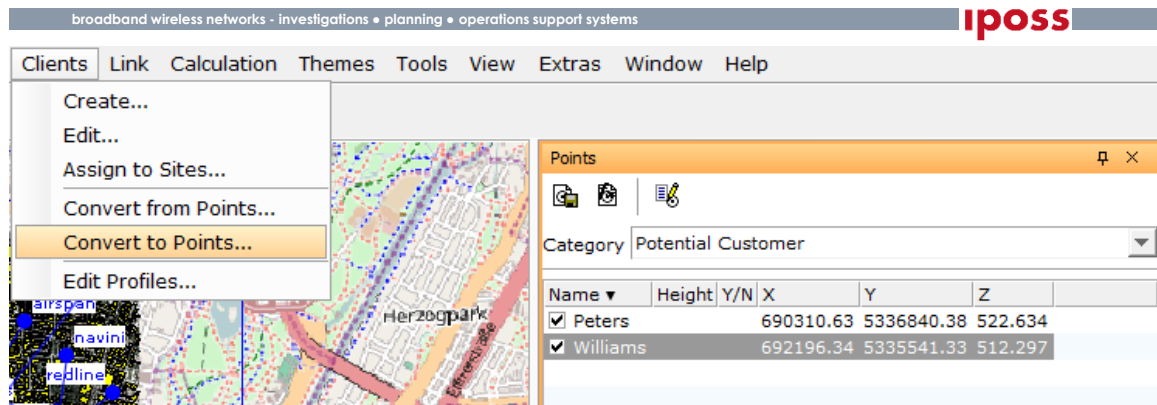


Figure 242: Mark a client and choose "Convert to Points"

Choose the point category that should be created from the clients and choose the **Height Column** of this point category. You can still uncheck the **Convert Height** checkbox. Feel free to create or edit new point categories by clicking on **Options→New** or **Options→Point Categories**.

Before finishing the conversion, choose the clients to be deleted after creating the points or to still occur afterwards.

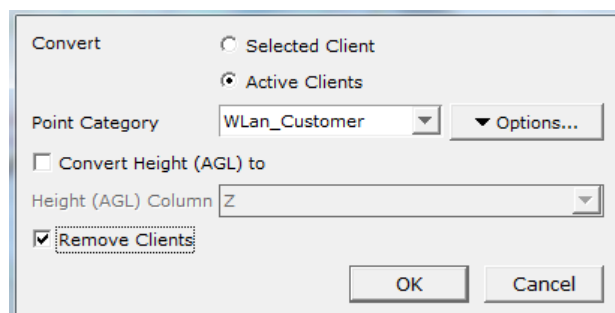


Figure 243: Remove clients after the conversion

3. Click **OK** to convert the clients to points.



Figure 244: The points appear on the map

8.8 Point Parameters



8.8.1 How to assign carrier

1. Take a right click on the point on the map or in the list tab of the points tab and click on **Edit....**

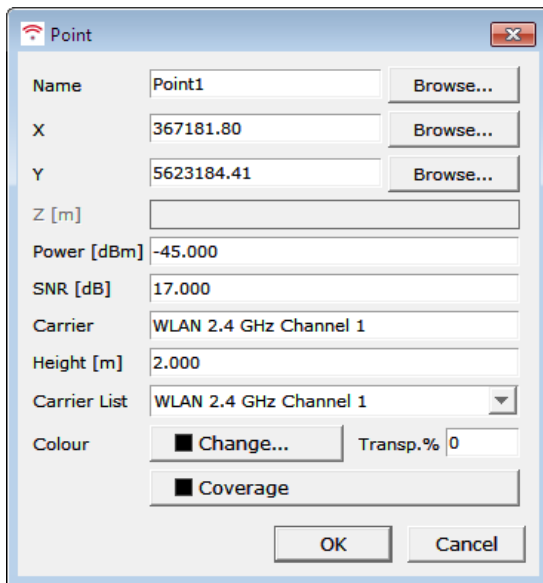


Figure 245: The edit window of a point

2. **Carrier List** selects the carrier of a list, a change will be applied in the text box **Carrier**. The text box can be changed manually but if the **Carrier** and the selected carrier by **Carrier List** are different, the function coverage cannot be used.



8.8.2 How to assign an URL

1. Take a right click on the point on the map or in the list tab of the points tab and click on **Edit....**

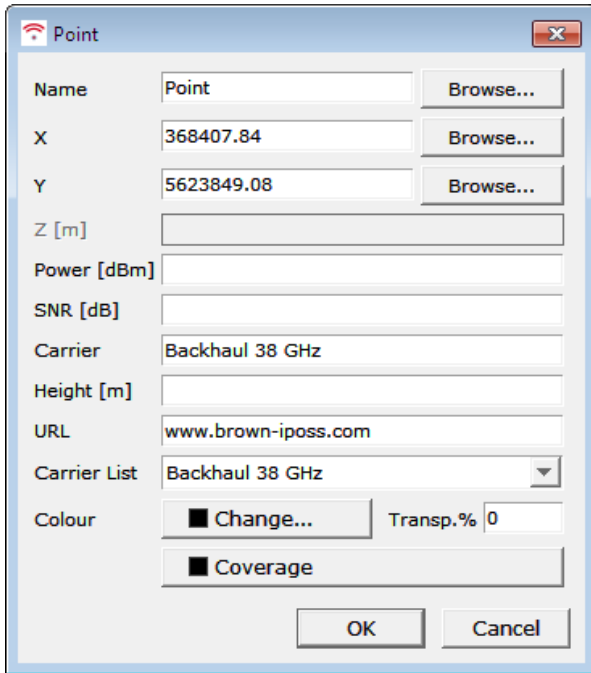


Figure 246: The edit window of a point with the parameter URL

2. Enter an URL in the field **URL** and close the window with **OK**.
3. Take a right click on the point on the map or in the list tab of the points tab and click on **Open Link to....**

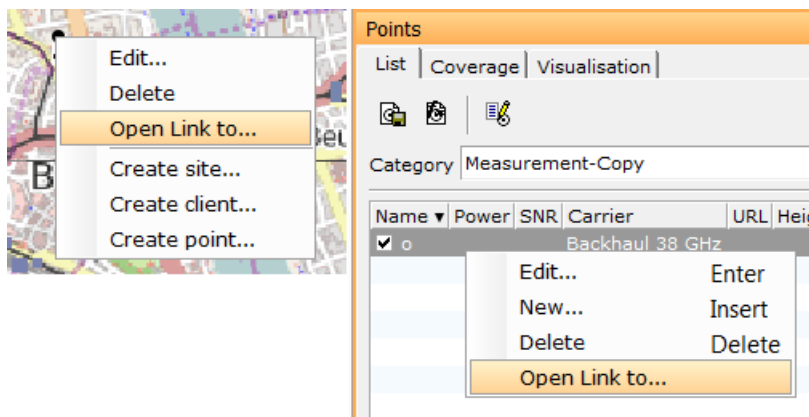


Figure 247: Point open link to...

Now the browser will be opened and load the homepage that stands in the parameter type **URL**.

9 Clients

Clients can be set to a specific point to make some additional calculations to see if this exact point is covered with a specific power level and which station should be used to get a good

signal. It can also be used for presentations to show customers everything will work out fine for them. Clients can be arranged in different client profiles or newly created. This makes sure, that, for example, the user does not plan a project for customers which uses the 5 GHz technology with a 2.4 GHz technology. It is more attracting for a customer to see everything work out fine with using the specific real values.

9.1 Client Profiles

As mentioned before, the client profiles helps the user to categorize customers in special groups that maybe only use a special technology like WiMAX or 5 GHz WLAN.



9.1.1 How to Create Client Profiles

1. Choose **Clients**→**Edit Profiles**.

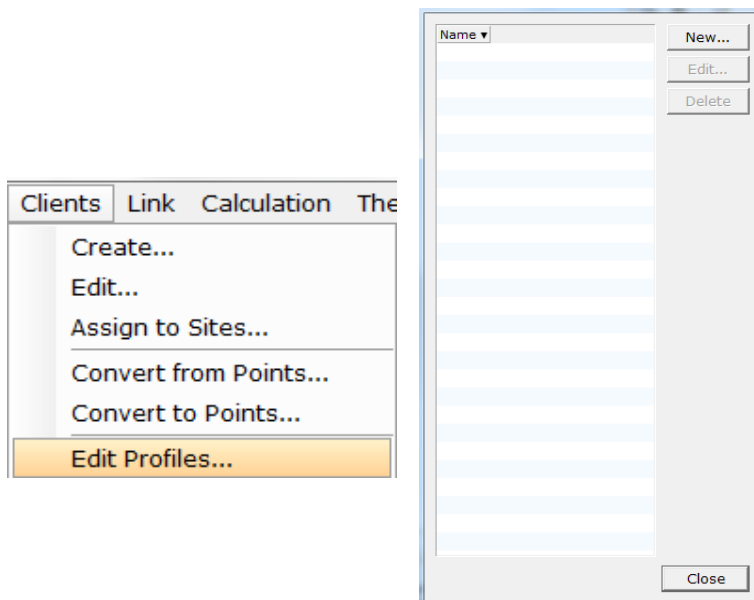


Figure 248: Create new client profiles

2. Choose **New** to create a new client profile.

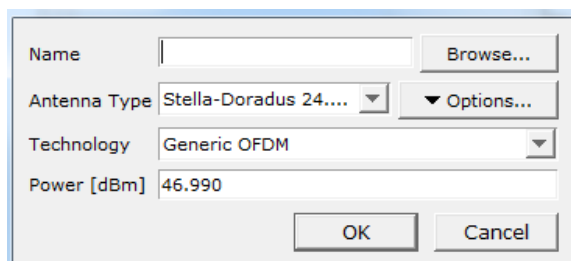


Figure 249: Fill in all fields

3. Name the new profile and choose the specific antenna type, technology and the power of the site.

If there are no antennas available, they need to be created before creating a client profile.



A short introduction how to create antennas can be found in chapter 7.1.1.1

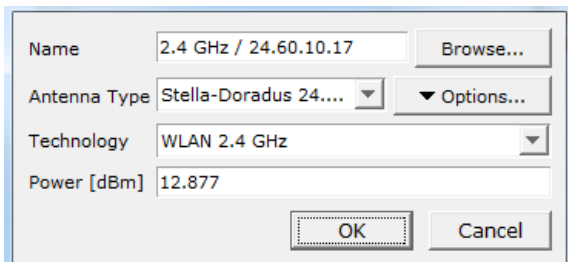


Figure 250: Fill in all fields

4. Click **Ok** to add this profile to the project.

Generally the user needs to generate more than one profile, so create as many as you need.

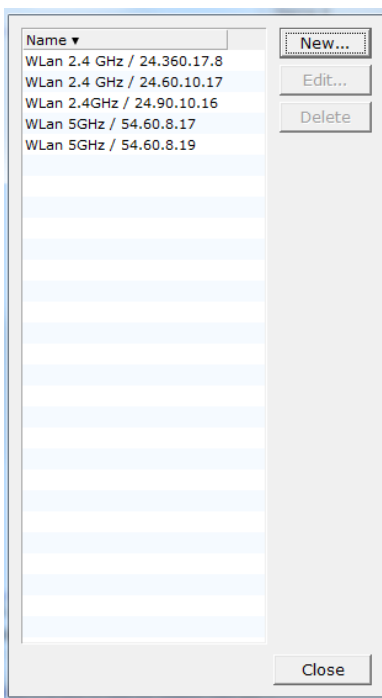


Figure 251: Created carriers

5. Click on **Close** to return to the map.



9.1.2 How to Edit Client Profiles

1. Choose **Clients→Edit Profiles**.

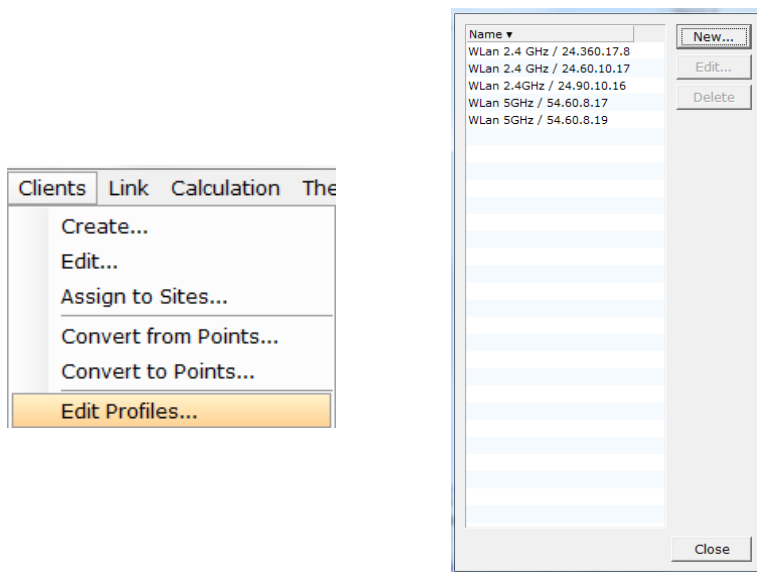


Figure 252: Edit carriers

2. Select a profile and click **OK** to edit it. If all settings are done, click **OK** to save the changes.

9.2 Client Creation

Assuming that all necessary client profiles are added, a client can be created now.



9.2.1 How to Create Clients

1. There are three possibilities to create a client in WiMAP-4G:

- Choose **Clients→Create**.

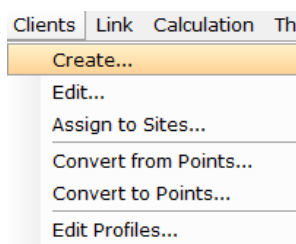


Figure 253: Create clients from the menu

- Right-click the desired position on the map and click on **Create Client**.

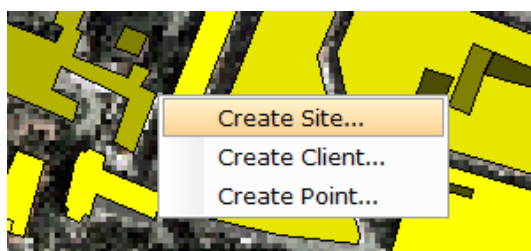
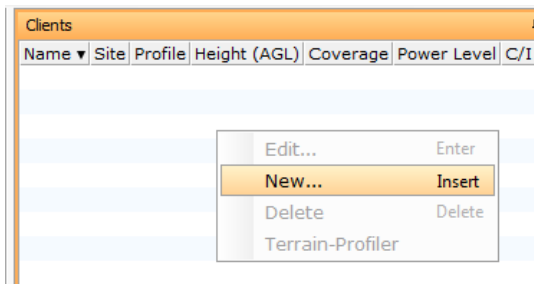


Figure 254: Create clients on the map

- *Right-click in the **Clients Tab** and choose **New**.*


Figure 255: Create clients from the clients tab


Clients can also be created in the Project-Explorer by clicking "Insert".

2. In the appearing windows, *enter the following values:*

- **Name of the client** (usually the customer)
- **The site which should be used by the client.**
- **The Client profile** - A client profile needs to be chosen. In case there is none, it needs to be created here.



A short introduction how to create client profiles can be found in chapter 9.1.1.

- **The carrier that should be used by the client.** - The carrier needs to be chosen to continue. It needs to be created if none is existing.



A short introduction how to create carrier profiles can be found in chapter 6.1.

- **The Height of the Clients Antenna** - This value could be really important according to the site position.
- **X- and Y-coordinates of the Client** - If the client was created with a right click on the map, the coordinates should be precise, but it is the same as for the height. Minimal changes can be important to get a signal, so try to use exact coordinates.

Beside the rows, there is a **Browse Button** which allows to enter the coordinates. If the user knows client coordinates of a coordinate system which is not used for the actual project, he can use them. The program itself will translate them to the actual project coordinate system.

- **The Z-coordinate** is the height of the ground itself. If an elevation model exists, the Z-coordinate will be automatically set to a value.

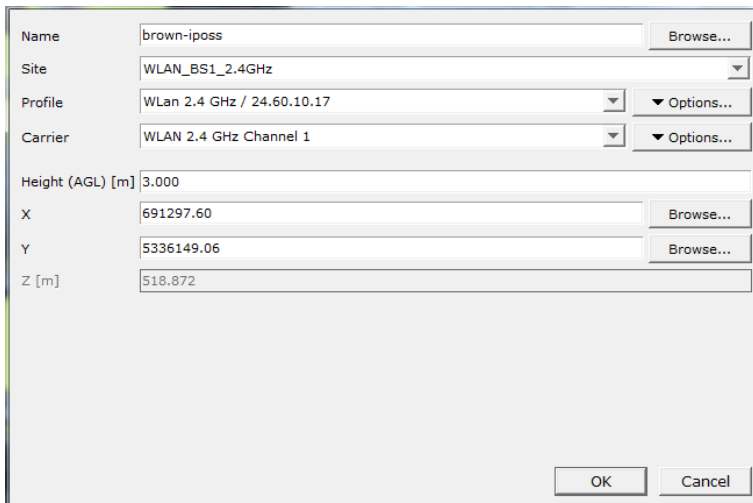


Figure 256: Fill in all fields

3. If everything is set, *click on **OK** to create the client.*



Figure 257: The client appears on the map

The client will show up on the map and a dashed line connect him with the site that he has been assigned to. If any calculation is done, the dashed line will turn into a solid one.

9.3 Edit Clients

Sometimes it is necessary to edit clients. For instance, a customer has changed his position on the map or he uses a different technology now.



9.3.1 How to Edit Clients

1. There are three possibilities to edit clients:

- *Right click on the client on the map and click on **Edit**.*

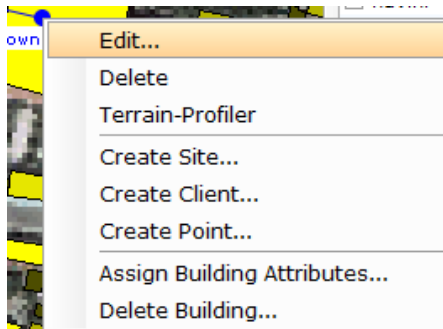


Figure 258: Edit clients from the menu

- *Choose the **Client Tab** in the **Project-Explorer**, right click on the client and choose **Edit**.*

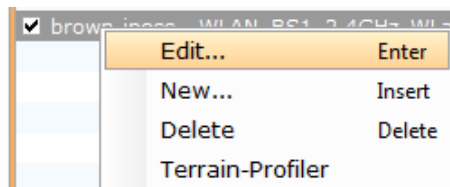


Figure 259: Edit clients in the clients tab

- *Choose **Clients**→**Edit**.*

(This is the fastest way to edit clients, because all clients are listed in the appearing window. The desired can be chosen and edited by double clicking on him.)

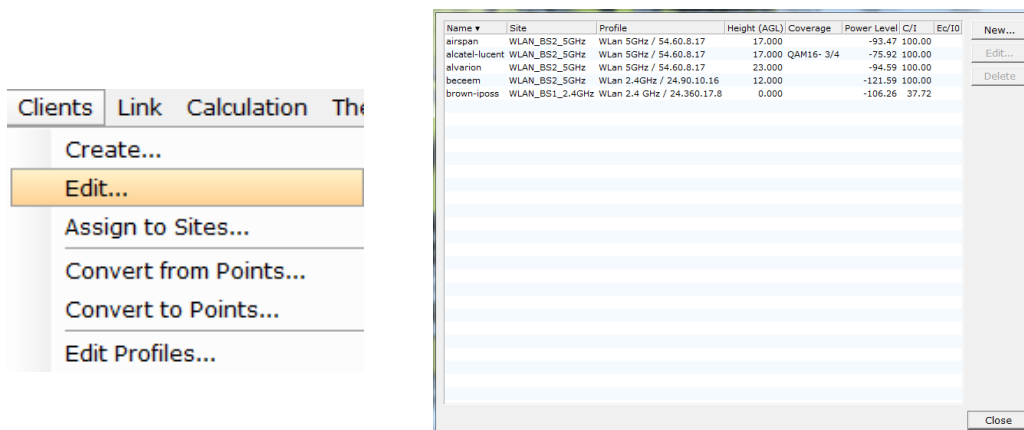


Figure 260: Choose the client and click on Edit.

2. Change the values for the client and click on **Ok** to save the settings.

9.4 Assign Clients to Sites

Clients can be assigned to the nearest site. To make it easier for the user, there is a setting to do that.



9.4.1 How to Assign Clients to Sites

1. Choose **Clients→Assign to Sites** and click on **OK**.

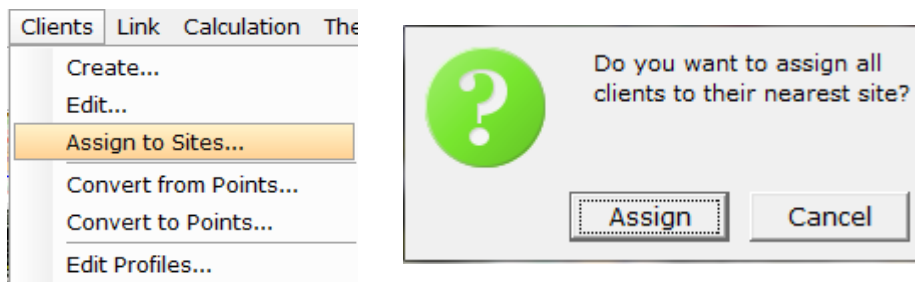


Figure 261: Assign clients to the nearest site

10 Calculations and Themes

Calculations and **themes** are the most interesting part of WiMAP-4G. Basically this is the aspect WiMAP-4G is in use. There are many detailed calculations and themes with a lot of settings that help to refine the result to the desired level. Before making any useful calculations or themes, the following things should be done:

- *elevation model imported*
- *correct sites created*
- *correct antennas created and used*
- *correct coordinates for antennas and sites*

Considering those as done, a proper calculation or theme can be made and the results can be used without any doubt. If there is no elevation model imported, the calculations or themes will be imprecise. These results should never be used to make a decision whether to build a planned scenario in reality or not.

10.1 Calculation and Theme Types

The following calculations are possible with WiMAP-4G:

- **field strength area**
- **client coverage**
- **point field strength**
- **site to site**

The follow themes are possible with WiMAP-4G:

- **coverage**
- **best server**
- **carrier to interferer**
- **power level**
- **Sub Carrier Interference**
- **field strength**
- **elevation**
- **visibility**

Themes always need results from a basic calculation to start calculating itself. So if an error occurs or nothing is shown after creating a theme, the first thing to check is whether the corresponding basic calculations have been done or not.

10.2 The Field Strength Area Calculation

The **field strength area calculation** is the most used calculation and always the basic calculation that has to be done before creating a theme. It shows the field strength for the whole marked blue area or if zoomed in, for the whole screen. The field strength area calculation can be made with all propagation models, except CORLA, where a license is needed for.



A license file is needed to use CORLA. This license is limited to a project and can be ordered at WIMAP-4G product support.



10.2.1 How to Make a Field Strength Area Calculation

1. There are three possibilities to open the field strength area calculation window:

- Choose **Calculation→Area Field Strength**.

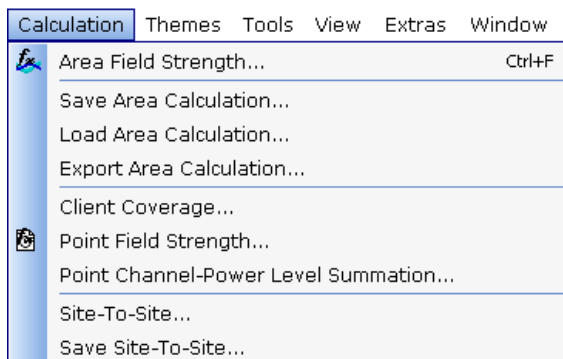


Figure 262: Make a field strength area calculation

- Click on  in the **control bar**.
- The shortcut for the field strength area calculation is **CTRL+F**.

2. The field strength area calculation window opens and some settings according to the situation have to be done.

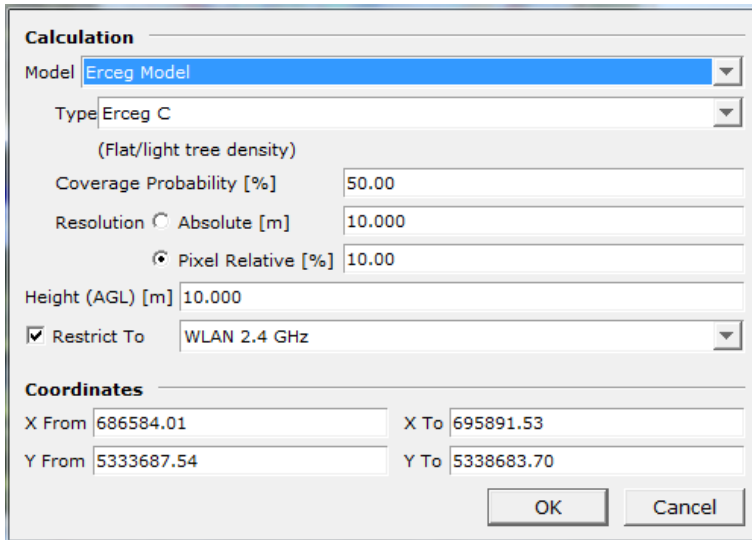


Figure 263: Field strength area calculation settings for the Erceg model

At first it need to be decided which propagation model should be used. All remaining settings depend on the specific propagation model.

10.2.1.1 With the Erceg Model

3.1.1.1 The first thing to decide is whether the calculation should be made with the Erceg A, B or C model. It depends on the environmental circumstances.

A: Hilly terrain with moderate to heavy tree density. This model is associated with the highest path loss.

B: Terrain type B is characterized by mostly flat terrain with moderate to heavy tree densities or a hilly terrain with light tree densities.

C: Terrain type C is used for flat terrain with light tree densities, producing the lowest path loss.

Custom: It is also possible to create a custom profile in the WiMAP-4G settings. This is only recommended for experienced users, who know the used parameters exactly and can handle them correctly.



For Community-Edition users, the calculation cannot be more precise than 50 m, which is usually enough to get an overview but not enough for a precise calculation.

Calculation

Model Erceg Model

Type Erceg A

(Hilly/moderate-to-heavy tree density)

Coverage Probability [%] 50.00

Resolution Absolute [m] 10.000

Pixel Relative [%] 10.00

Height (AGL) [m] 10.000

☒ Restrict To WLAN 2.4 GHz

Coordinates

X From 687177.39 X To 695298.15

Y From 5333875.62 Y To 5338495.62

OK Cancel

Figure 264: Choose the type that fits the situation.

3.1.2 The coverage probability has to be set. It can be set to a standard value in the WiMAP-4G-settings. It is a little bit tricky to understand the function of that value. It describes the chance that - considering all circumstances - a specific point receives the calculated field strength in real terms. The coverage is always based on probability theory and cannot be guaranteed 100 % of the time. This probability maybe affected by weather or atmospheric conditions. For high frequency carriers the weather can make the little difference between a working and a useless signal. The temperature is able to affect the coverage, too. Depending on this, it is always recommended to set this value not too low. The calculation result may look very nice in theory, but in reality none of the customers may receive a satisfying signal. That would be a disaster. A good result with a high value as for example 70% is a good basis for a real project.



Figure 265: 50 % coverage probability

For example for the rectangle in the Figure 265 , there is a 50 % chance this area receives a signal, which can be demodulated with QAM 64.



To change the model parameters or the standard coverage probability, see chapter 3.1.2.2.3

3.1.3 The resolution of the calculation can be set to % or m. Higher % means higher precision whereas the value in m needs to be low for higher precision. Note, that a higher precision always requires more time for calculation.

It can take hours or even days if the project is big. So keep in mind to run a test calculation with a low precision first. Nothing is more frustrating than to calculate a project for a few hours when the result looks bad because something has been overseen.

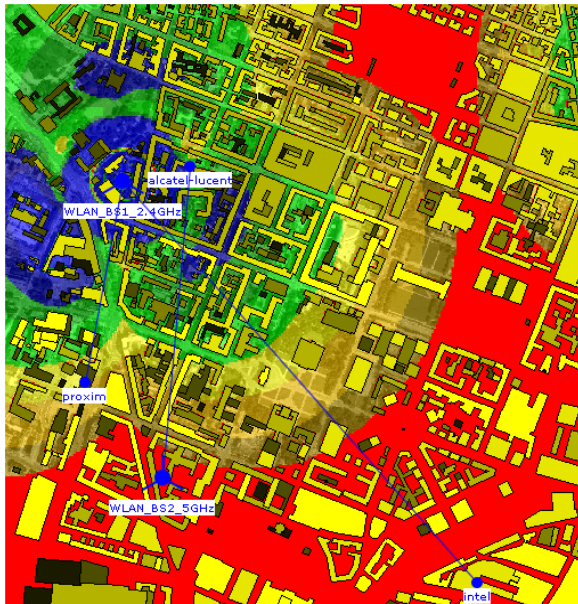


Figure 266: A field strength area calculation example:
Munich, Erceg A, coverage probability: 50 %, resolution: absolute 5 m

10.2.1.2 With the CORLA Raylauncher Model

3.2.1 The CORLA Raylauncher settings which can be made during a field strength area calculation are limited. First of all, the precision in X/Y-direction and in Z-direction can be set in meter. Note, that a higher precision always requires more time for calculation. This can take hours or even days if the project is big. So keep in mind to run a test calculation with a low precision first. Nothing is more frustrating than to calculate a project for a few hours when the result looks bad because something has been overseen.

3.2.2 Choose a **working directory** for CORLA. Usually it does not need to be edited. CORLA only needs to create a few temporary files while calculating.

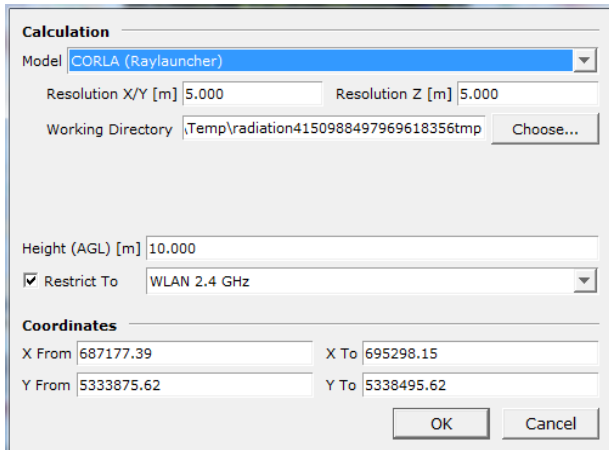


Figure 267: Field strength area calculation settings for CORLA Raylauncher



To configure the CORLA Raylauncher, see chapter 3.1.2.3.



Note that the CORLA Raylauncher needs a license for a specific environment and can only be used by Professional-Edition users.

10.2.1.3 With the ITU-R P.1411-3 Model

3.3.1 Choose the **average road orientation** in °. This can be set to a standard value in the settings.

3.3.2 The resolution of the calculation can be set to % or m. Higher % means higher precision whereas the value in m needs to be low for higher precision. Note, that a higher precision always requires more time for calculation. This can take hours or even days if the project is big. So keep in mind to run a test calculation with a low precision first. Nothing is more frustrating than to calculate a project for a few hours when the result looks bad because something has been overseen.

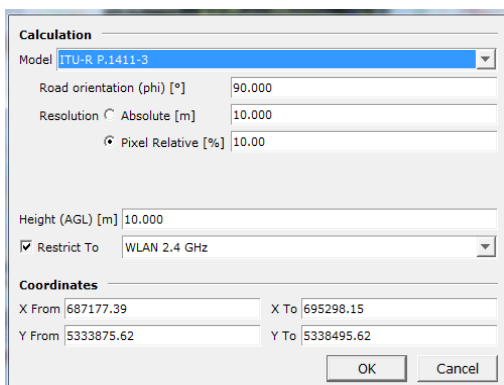


Figure 268: Field strength area calculation settings for ITU-R P.1411-3



To configure the ITU-R P.1411-3, see chapter 3.1.2.2.2.

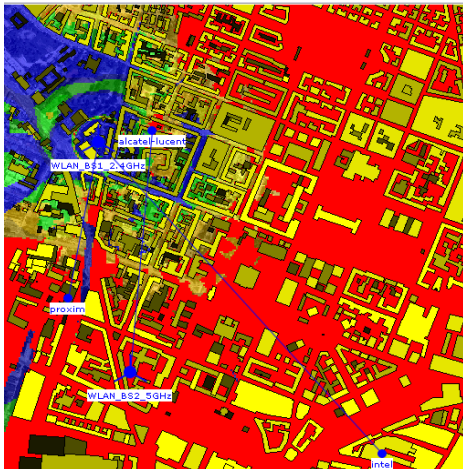


**Figure 269: A field strength area calculation example:
Munich, ITU-R P.1411-3, road orientation: 90°, resolution: absolute 5 m**

10.2.1.4 With the Free Space Propagation Model

3.4.1 The Free Space Propagation model is the easiest model of all and therefore it does not need a lot of adjustments. The resolution of the calculation can be set either in % or in m. Higher % means higher precision whereas the value in m needs to be low for a good precision. Note, that a higher precision always requires more time for calculation. This can take hours or even days if the project is big. So keep in mind to run a test calculation with a low precision first. Nothing is more frustrating than to calculate a project for a few hours when the result looks bad because something has been overseen.

Calculation

Model: Free Space Propagation

Resolution: ☐ Absolute [m] 10.000
☒ Pixel Relative [%] 10.00

Height (AGL) [m]: 10.000

☒ Restrict To: WLAN 2.4 GHz

Coordinates

X From: 687177.39 X To: 695298.15
Y From: 5333875.62 Y To: 5338495.62

OK Cancel

Figure 270: Field strength area calculation settings for Free Space Propagation



To configure the Free Space Propagation model, see chapter 3.1.2.2.1.

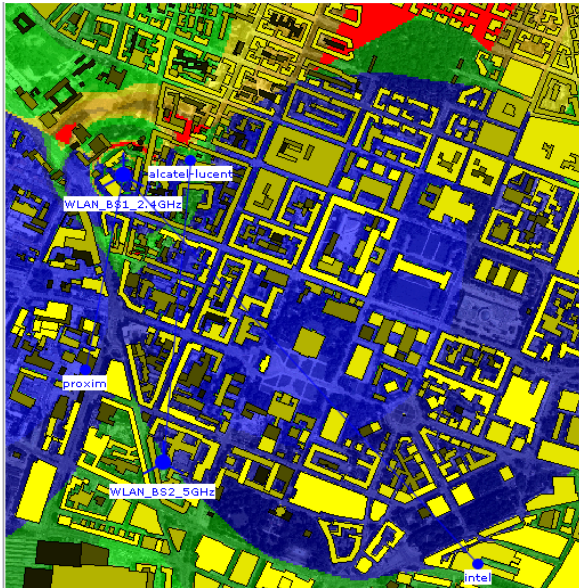


Figure 271: A field strength area calculation example: Munich, Free Space Propagation, Resolution: absolute 5 m

10.2.1.5 With the WinProp

3.5.1 WinProp is for propagation modeling in different scenarios with different model types of calculation.

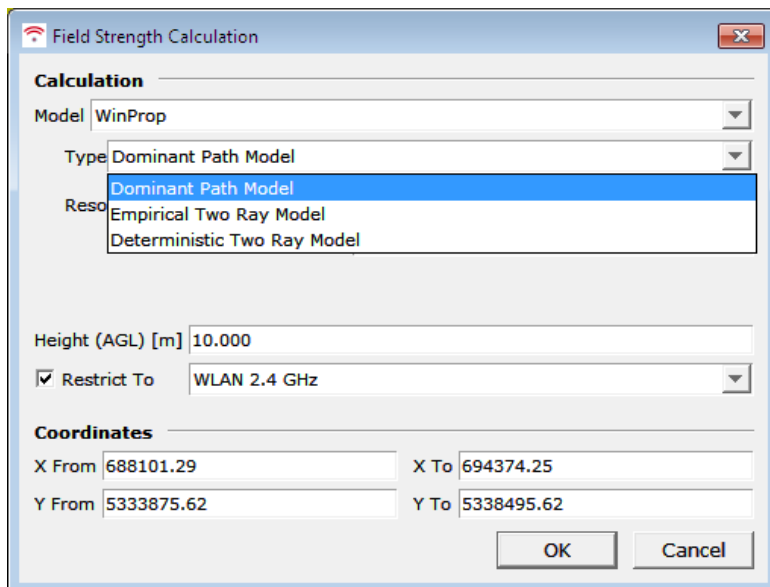


Figure 272: WinProp Field Strength Calculations settings

3.5.1.1 The **Dominant Path Model** calculate the path loss on the main paths between transmitter and each receiver pixel by high precision like the ray tracing.

3.5.1.2 The Okumura-Hata Model calculate the path loss based on four factor, *frequency* (between 150MHz – 1500MHz), *distance* (1km – 20km between transmitter and receiver), *height of transmitter* (between 30m – 200m), and *height of receiver* (between 1m – 10m).

3.5.1.3 The Empirical Two Ray Model calculate the path loss by each pixel on the map, without looking for the point is hidden or unreachable.

3.5.1.4 The Deterministic Two Ray Model calculate the path loss by each pixel on the map with checking whether the point is not hidden and reachable.



A special license is needed to use WinProp models, which can be ordered at WIMAP-4G product support.

10.2.1.6 General Settings

4. After deciding on a propagation model and configuring it, there are a few additional settings that need to be done. First of all, we need to set the height of the calculation above ground level. Usually this value should be something as the antenna height or corresponding. A low value, for example, 1 m could cause a bad result, because at this height, there are a lot of interferers for the signal.

5. Next thing to decide is, if the calculation is restricted to a specific technology. This can be useful in large projects with many different technologies in use. Note that the program will simply calculate in all technologies without a restriction which may double or multiple the calculation time in some cases.

6. At last, the specific coordinates of the calculated area can be set. If the blue area frame is shown on the screen, the coordinates will always be the coordinates of the vertices of that blue frame.

7. When all settings are done, *click on **OK** to start the calculation*. As mentioned above, a calculation can take some time, so do not close the program.

10.3 The Client Coverage Calculation

The **client coverage calculation** is a useful feature of WiMAP-4G, for example, to calculate the exact power level for the real position of a client. The alternative to get a power level for a client is to simply read them on the map after doing a power level calculation. This alternative will not be exact as long as the user does not specify a few 1000 color profiles. It is not necessary, because there is the client coverage calculation.

The client tab in the Project-Explorer shows all clients used in the current project and the according values: coverage, power level, C/I (carrier to interferer).

Clients						
Name ▼	Site	Profile	Height (AGL)	Coverage	Power Level	C/I
☒ airspan	WLAN_BS2_5GHz	WLAN 5GHz Net	17.000			
☒ alcatel-lucent	WLAN_BS2_5GHz	WLAN 5GHz Net	17.000	QAM16- 3/4	-75.92	100.00
☒ alvarion	WLAN_BS2_5GHz	WLAN 5GHz Net	23.000			
☒ beceem	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	12.000	QAM16- 1/2	-77.13	17.05
☒ brown-iposs	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	25.000		-71.77	2.11
☒ intel	WLAN_BS1_2.4GHz	Wlan 2.4GHz Net	26.000	QPSK- 3/4	-81.70	18.91
☒ navini	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	23.000	QAM16- 3/4	-65.21	20.34
☒ proxim	WLAN_BS1_2.4GHz	Wlan 2.4GHz Net	8.000			
☒ redline	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	14.000	QAM64- 1/2	-69.11	25.99

Figure 273: The clients tab in the Project-Explorer

Note that the client coverage calculation does not show any visual effects in the Terrain-Explorer. Only the clients tab in the Project-Explorer will change during a calculation.



If not all columns are visible, the project explorer needs to be dragged to the right width.



10.3.1 How to Make a Client Coverage Calculation

1. Choose **Calculation**→**Client Coverage**.

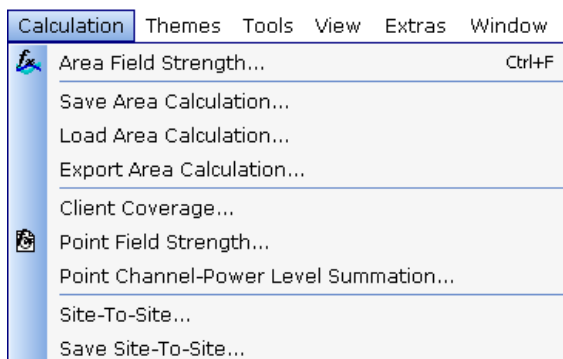


Figure 274: Open the client coverage calculation settings

2. The client coverage calculation window opens and some settings according to the situation have to be done.

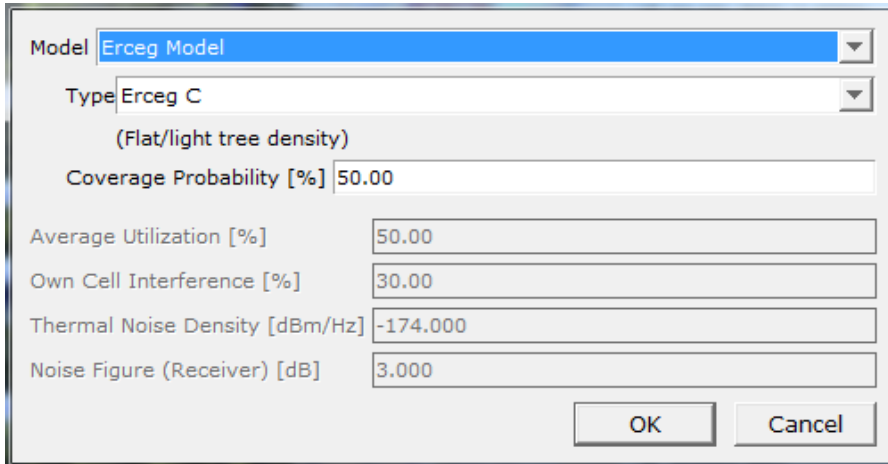


Figure 275: The coverage calculation settings

First of all, a propagation model needs to be chosen. The rest of the settings depend on the specific propagation model.

10.3.1.1 With the Erceg Model

3.1.1 The first thing to decide is whether the calculation should be made with the Erceg A, B or C model. It depends on the environmental circumstances.

A: Hilly terrain with moderate to heavy tree density. This model is associated with the highest path loss.

B: Terrain type B is characterized by mostly flat terrain with moderate to heavy tree densities or a hilly terrain with light tree densities.

C: Terrain type C is used for flat terrain with light tree densities, producing the lowest path loss.

Custom: It is also possible to create a custom profile in the WiMAP-4G settings. This is only recommended for experienced users, who know the exact used parameters and can handle them correctly.

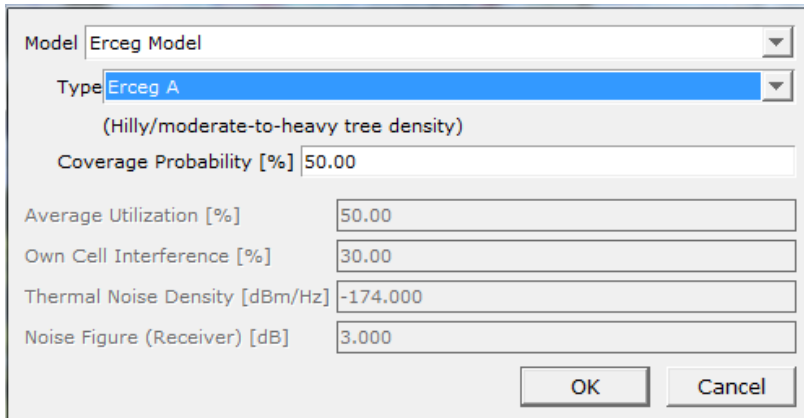


Figure 276: Choose the type that fits the situation

3.1.2 The coverage probability has to be set. It can also be set to a standard value in the WiMAP-4G-settings. It is a little bit tricky to understand the function of that value. It describes the chance that, considering all circumstances, a specific point receives the calculated field strength in real terms. The coverage is always based on probability theory and cannot be guaranteed 100 % of the time. This probability maybe affected by weather or atmospheric conditions.

For high frequency carriers the weather can make the little difference between a working and a useless signal. The temperature is able to affect the coverage, too. Depending on this, it is always recommended to not set this value to low. The calculation result may look very

nice in theory, but in reality none of the customers may receive a satisfying signal. That would be a disaster. A good result with a high value as for example 70 % is a good basis for a real project.



Figure 277: 50 % coverage probability

For example for the rectangle in the figure above, there is a 50 % chance, that this area receives a signal, which can be demodulated with QAM 64.



To change the model parameters or the standard coverage probability, see chapter 3.1.2.2.3.

Clients							
Name	Site	Profile	Height (AGL)	Coverage	Power Level	C/I	
☒ beceem	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	12.000	QAM16- 1/2	-77.13	32.73	
☒ proxim	WLAN_BS1_2.4GHz	Wlan 2.4GHz Net	8.000		-111.11	0.06	
☒ redline	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	14.000	QPSK- 3/4	-81.73	30.44	

Figure 278: A client coverage calculation example: Munich, Erceg A, coverage probability: 50 %

10.3.1.2 With the CORLA Raylauncher Model

3.2.1 The CORLA Raylauncher settings which can be made during a client coverage calculation are limited. First of all, the precision in X-/Y-direction and in Z-direction can be set in meter. Note, that a higher precision always requires more time for calculation. This can take hours or even days if the project is big. So keep in mind to run a test calculation

with a low precision first. Nothing is more frustrating than to calculate a project for a few hours when the result looks bad because something has been overseen.

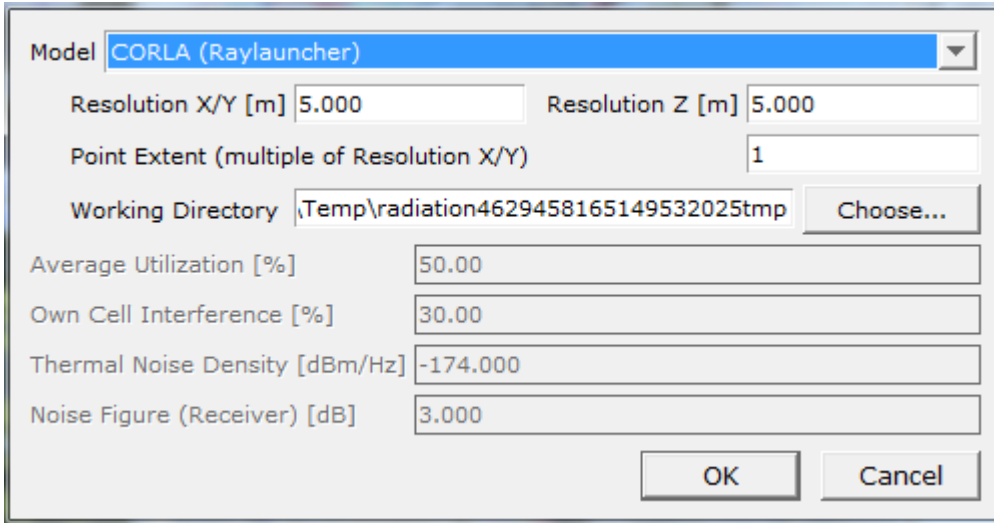


Figure 279: Client coverage calculation settings for CORLA

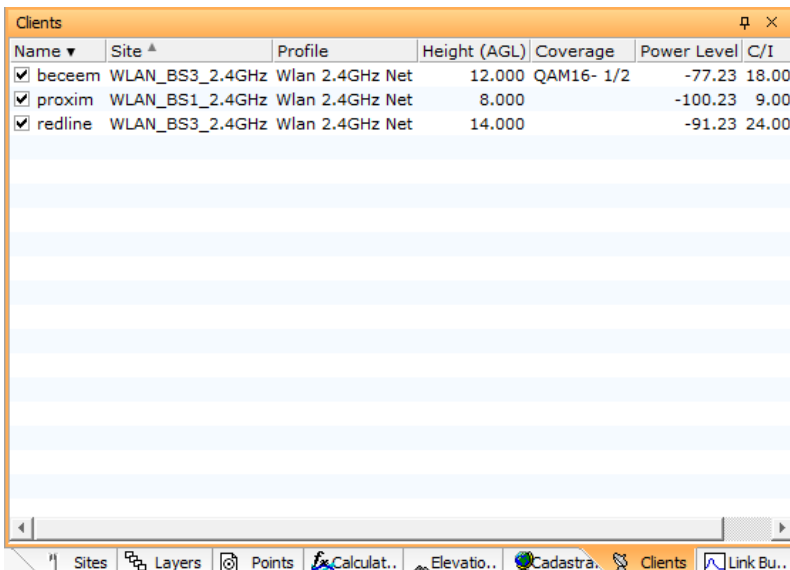
3.2.3 Choose a **working directory** for CORLA. Usually it does not need to be edited. CORLA only needs to create a few temporary files while calculating.



To configure the CORLA Raylauncher, see chapter 3.1.2.3.



Note that the CORLA Raylauncher needs a license for a specific environment and can only be used by Professional-Edition users.



Name	Site	Profile	Height (AGL)	Coverage	Power Level	C/I
☒ beceem	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	12.000	QAM16- 1/2	-77.23	18.00
☒ proxim	WLAN_BS1_2.4GHz	Wlan 2.4GHz Net	8.000		-100.23	9.00
☒ redline	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	14.000		-91.23	24.00

Figure 280: A client coverage calculation example:

Munich, CORLA, resolution x/y: 3, resolution z: 3, point extent: 1

10.3.1.3 With the ITU-R P.1411-3 Model

3.3.1 Choose the *average road orientation* in °. This can be set to a standard value in the settings.

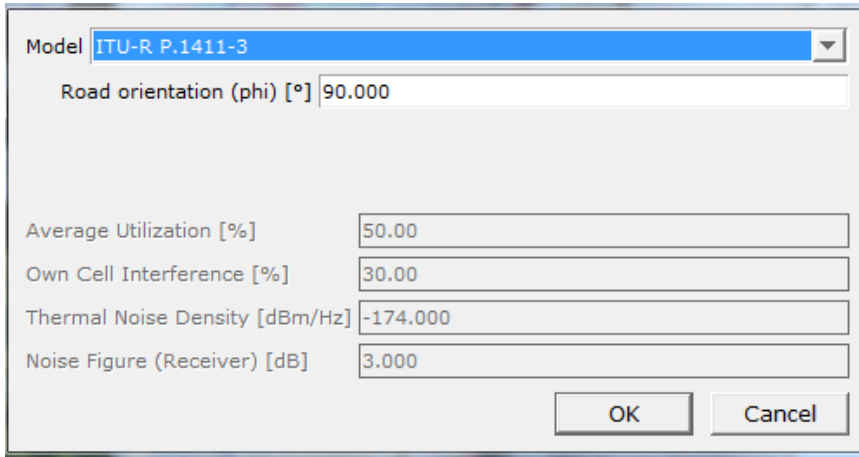
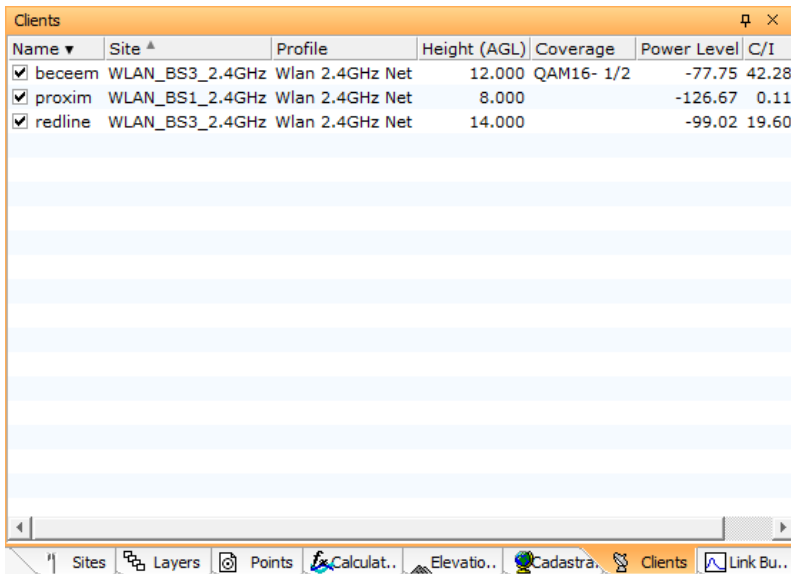


Figure 281: Client coverage calculation settings for ITU-R P.1411-3



To configure the ITU-R P.1411-3, see Chapter 3.1.2.2.2.



Name	Site	Profile	Height (AGL)	Coverage	Power Level	C/I
☒ beceem	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	12.000	QAM16- 1/2	-77.75	42.28
☒ proxim	WLAN_BS1_2.4GHz	Wlan 2.4GHz Net	8.000		-126.67	0.11
☒ redline	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	14.000		-99.02	19.60

Figure 282: A client coverage calculation example: Munich, ITU-R P.1411-3, road orientation: 90°

10.3.1.4 With the Free Space Propagation Model

3.4.1 The Free Space Propagation model is the easiest model, it does not need any parameters.

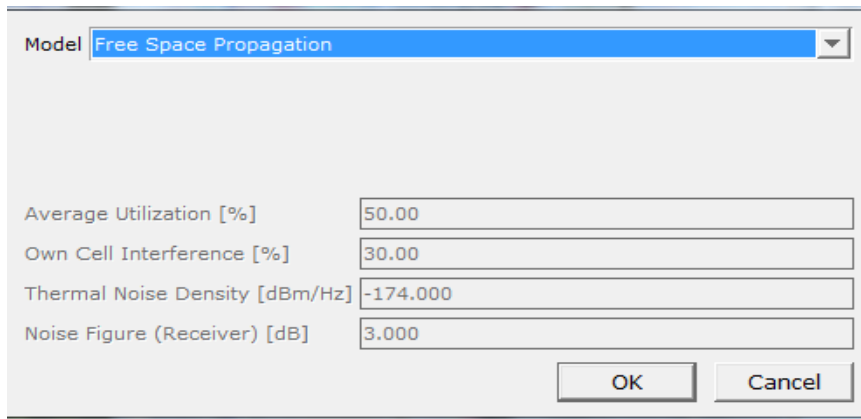
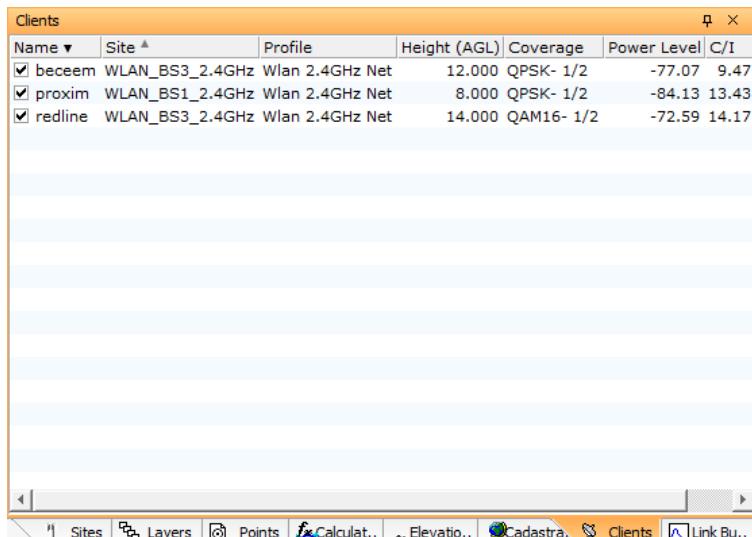


Figure 283: Client coverage calculation settings for Free Space Propagation



To configure the Free Space Propagation model, see chapter 3.1.2.2.1.

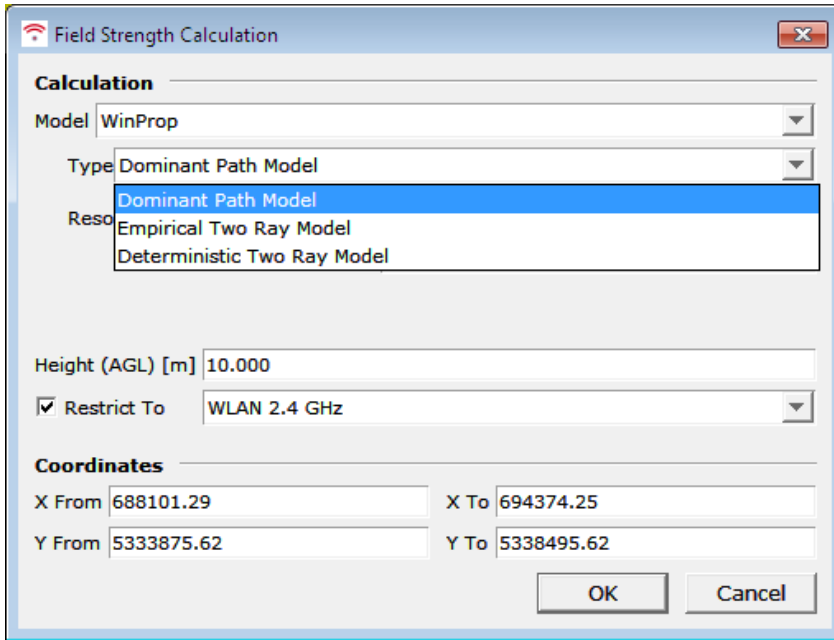


Name	Site	Profile	Height (AGL)	Coverage	Power Level	C/I
☒ beceem	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	12.000	QPSK- 1/2	-77.07	9.47
☒ proxim	WLAN_BS1_2.4GHz	Wlan 2.4GHz Net	8.000	QPSK- 1/2	-84.13	13.43
☒ redline	WLAN_BS3_2.4GHz	Wlan 2.4GHz Net	14.000	QAM16- 1/2	-72.59	14.17

Figure 284: A client coverage calculation example: Munich, Free Space Propagation

10.3.1.5 With the WinProp

3.5.1 WinProb is for propagation modeling in different scenarios with different model types of calculation.



The dialog box is titled "Field Strength Calculation". It has a "Calculation" section with a "Model" dropdown set to "WinProp", a "Type" dropdown set to "Dominant Path Model", and a "Resolution" list with three options: "Dominant Path Model" (selected), "Empirical Two Ray Model", and "Deterministic Two Ray Model". Below this is a "Height (AGL) [m]" input field set to "10.000" and a checked "Restrict To" dropdown set to "WLAN 2.4 GHz". The "Coordinates" section has four input fields: "X From" (688101.29), "X To" (694374.25), "Y From" (5333875.62), and "Y To" (5338495.62). At the bottom are "OK" and "Cancel" buttons.

Figure 285: WinProp Field Strength Calculations settings

3.5.1.1 The Dominant Path Model calculate the main paths between transmitter and each receiver pixel by high precision like the ray tracing.

3.5.1.2 The Okumura-Hata Model calculate the path loss based on four factor, *frequency* (between 150MHz – 1500MHz), *distance* (1km – 20km between transmitter and receiver), *height of transmitter* (between 30m – 200m), and *height of receiver* (between 1m – 10m).

3.5.1.3 The Empirical Two Ray Model calculate the path loss by each pixel on the map, without looking for the point is hidden or unreachable.

3.5.1.4 The Deterministic Two Ray Model calculate the path loss by each pixel on the map with checking whether the point is not hidden and reachable.



A special license is needed to use WinProp models. This license can be ordered at WIMAP-4G product support.

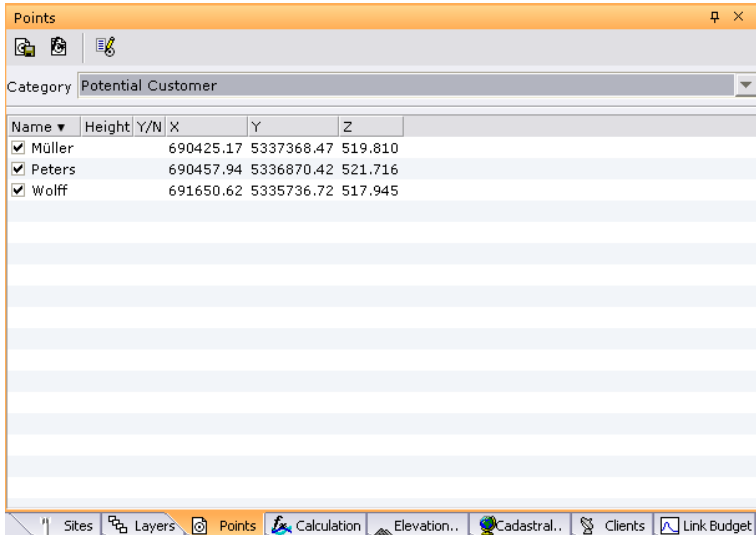
10.4 The Point Field Strength Calculation

The **point field strength calculation** works similar to the client coverage calculation and therefore it is a powerful tool. The exact field strength and power level for each point on the map can be calculated easily using this feature. The alternative to get a power level and field strength for points is to just read them on the map after creating a power level theme. This one will not be exact as long as the user does not specify a few 1000 color profiles. Instead,

the field strength of a point can be calculated. The points tab in the Project-Explorer shows all points used in the current project.



To create points on the map see chapter 9.2.



Name	Height	Y/N	X	Y	Z
☒ Müller	690425.17	5337368.47	519.810		
☒ Peters	690457.94	5336870.42	521.716		
☒ Wolff	691650.62	5335736.72	517.945		

Figure 286: The points tab in the Project-Explorer

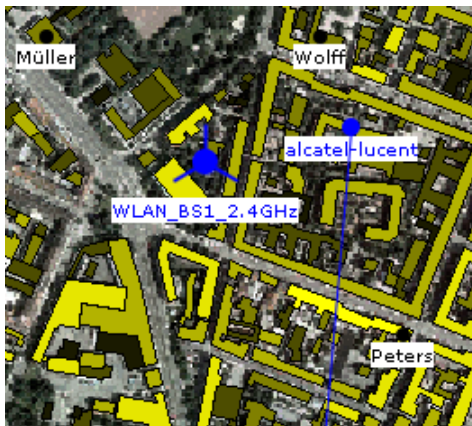


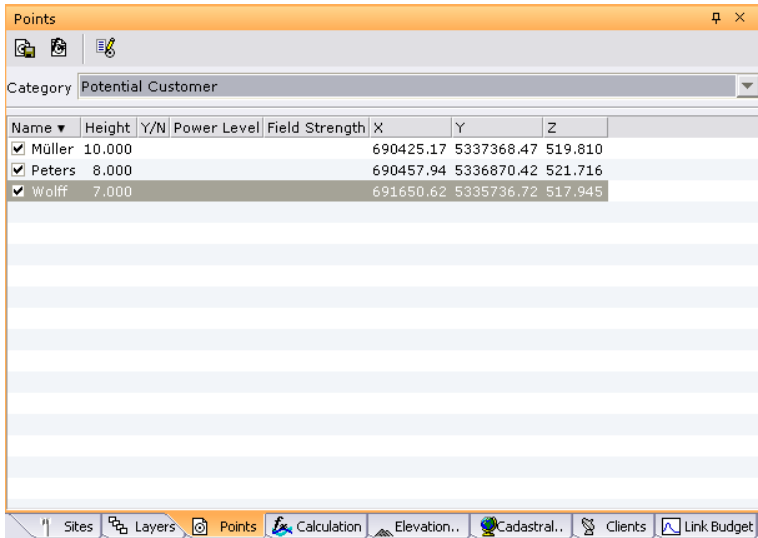
Figure 287: The points on the Terrain-Explorer

The images above show the points of the corresponding point category. A field strength or power level column is required for this calculation to make sense. They need to be created for the corresponding point category before making a point field strength calculation.



To edit point classes see chapter 9.1.1 and 9.1.2.

If the point categories have been edited correctly, the point tab should look like the Figure 288:



Name	Height	Y/N	Power Level	Field Strength	X	Y	Z
☒ Müller	10.000				690425.17	5337368.47	519.810
☒ Peters	8.000				690457.94	5336870.42	521.716
☒ Wolff	7.000				691650.62	5335736.72	517.945

Figure 288: The points tab in the Project-Explorer with additional power level and field strength columns

The height of a point also influences the calculation result and should be entered to the corresponding field.



10.4.1 How to Make a Point Field Strength Calculation

After editing the point categories and the correct information to the corresponding fields, a point field strength calculation can be done.

1. There are two possibilities to make a point field strength calculation:

- Choose **Calculation→Point Field Strength**.

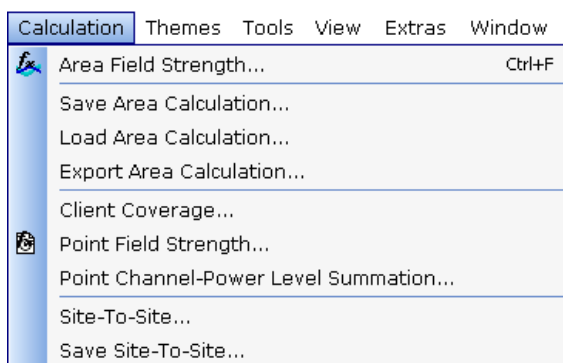
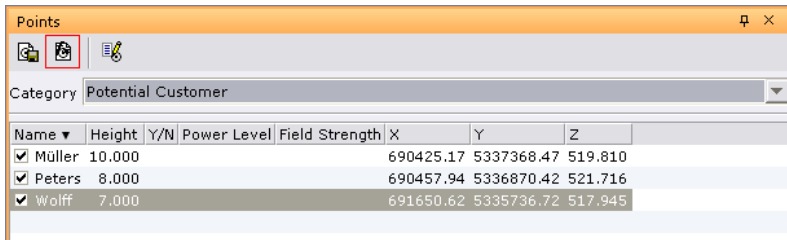


Figure 289: Open the settings from menu



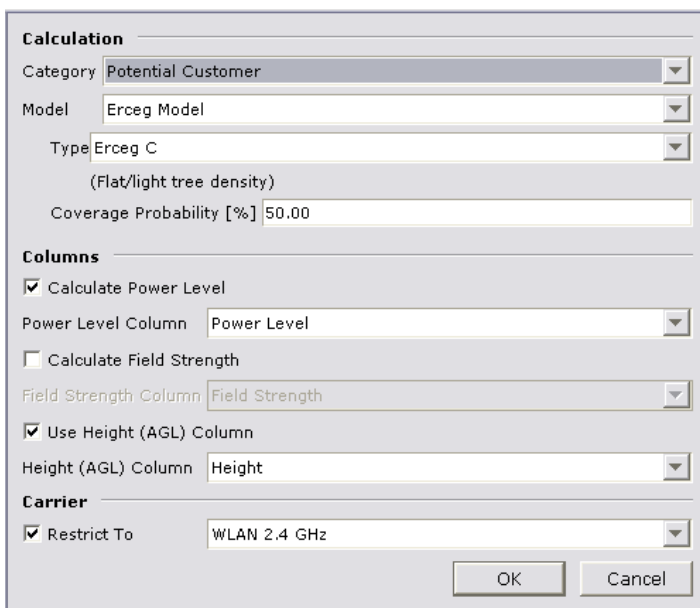
- Click the **in the *point* tab in the *Project-Explorer*.**



Name	Height	Y/N	Power Level	Field Strength	X	Y	Z
✓ Müller	10.000				690425.17	5337368.47	519.810
✓ Peters	8.000				690457.94	5336870.42	521.716
✓ Wolff	7.000				691650.62	5335736.72	517.945

Figure 290: Open the settings from points tab

2. When the point field strength calculation window opens, some settings according to the situation have to be done.



Calculation

Category: Potential Customer

Model: Erceg Model

Type: Erceg C
(Flat/light tree density)

Coverage Probability [%]: 50.00

Columns

☒ Calculate Power Level
Power Level Column: Power Level

☐ Calculate Field Strength
Field Strength Column: Field Strength

☒ Use Height (AGL) Column
Height (AGL) Column: Height

Carrier

☒ Restrict To: WLAN 2.4 GHz

OK Cancel

Figure 291: The point field strength calculation settings

First of all, it needs to be decided which points should be calculated. All points corresponding to the same point category can be calculated at a time. In this tutorial, all points associated with the point category **Potential Customer** will be calculated.



10.4.1.1 With the Erceg Model

3.1.1 The first thing to decide is whether the calculation should be made with the Erceg A, B or C model. It depends on the environmental circumstances.

A: Hilly terrain with moderate to heavy tree density. This model is associated with the highest path loss.

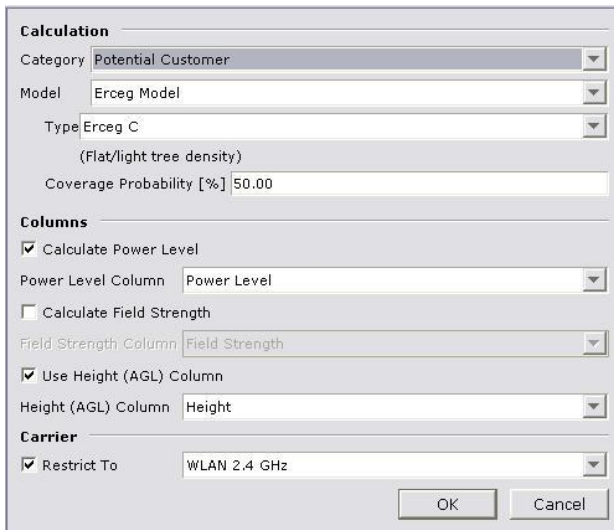
B: Terrain type B is characterized by mostly flat terrain with moderate to heavy tree densities or a hilly terrain with light tree densities.

C: Terrain type C is used for flat terrain with light tree densities, producing the lowest path loss.

Custom: It is also possible to create a custom profile in the WiMAP-4G settings. This is only recommended for experienced users, who know the used parameters exactly and can handle them correctly.



For Community-Edition users, the calculation cannot be more precise than 50 m, which is usually enough to get an overview but not enough for a precise calculation.



The dialog box is titled "Calculation". It contains the following sections:

- Category:** Potential Customer (dropdown)
- Model:** Erceg Model (dropdown)
- Type:** Erceg C (dropdown)
- (Flat/light tree density)**
- Coverage Probability [%]:** 50.00 (text input)
- Columns:**
 - ☒ Calculate Power Level
 - Power Level Column:** Power Level (dropdown)
 - ☐ Calculate Field Strength
 - Field Strength Column:** Field Strength (dropdown)
 - ☒ Use Height (AGL) Column
 - Height (AGL) Column:** Height (dropdown)
- Carrier:**
 - ☒ Restrict To: WLAN 2.4 GHz (dropdown)

Buttons: OK, Cancel

Figure 292: Choose the type that fits the situation

3.1.2 The coverage probability has to be set. It can be set to a standard value in the WiMAP-4G-settings. It is a little bit tricky to understand the function of that value. It describes the chance that, considering all circumstances, a specific point receives the calculated field strength in real terms. The coverage is always based on probability theory and cannot be guaranteed 100 % of the time. This probability maybe affected by weather or atmospheric conditions. For high frequency carriers the weather can make the little difference between a working and a useless signal. The temperature is able to affect the coverage, too. Depending on this, it is always recommended to not set this value to low. The calculation result may look very nice in theory, but in reality none of the customers may receive a satisfying signal. That would be a disaster. A good result with a high value as for example 70 % is a good basis for a real project.



Figure 293: 50 % coverage probability

For example for the rectangle in the figure above, there is a 50 % chance this area receives a signal, which can be demodulated with QAM 64.



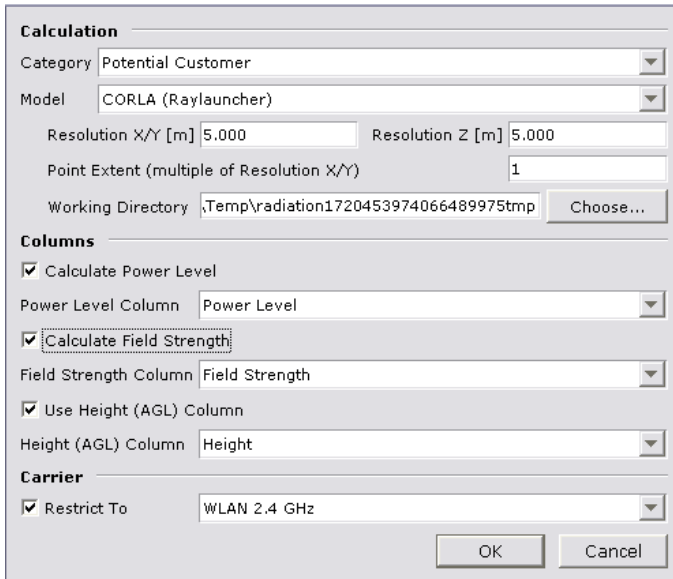
To change the model parameters or the standard coverage probability, see chapter 3.1.2.2.3.

Points								
Category Potential Customer								
Name	Height	Y/N	Power Level	Field Strength	X	Y	Z	
☒ Müller	10.000		-85.3	0.003	690161.99	5336395.45	521.900	
☒ Peters	8.000		-84.8	0.003	690601.65	5336029.06	518.839	
☒ Wolff	7.000		-90.6	0.001	690499.51	5336395.45	518.398	

**Figure 294: A point field strength calculation example:
Munich, Erceg A, coverage probability: 50 %, resolution: absolute 5 m**

10.4.1.2 With the CORLA Raylauncher Model

3.2.1 The CORLA Raylauncher settings which can be made during a point field strength calculation are limited. First of all, the **precision** in X-/Y-direction and in Z-direction can be set in meter. Note, that a higher precision always requires more time for calculation. This can take hours or even days if the project is big. So keep in mind to run a test calculation with a low precision first. Nothing is more frustrating than to calculate a project for a few hours when the result looks bad because something has been overseen.



Calculation

Category: Potential Customer

Model: CORLA (Raylauncher)

Resolution X/Y [m]: 5.000 Resolution Z [m]: 5.000

Point Extent (multiple of Resolution X/Y): 1

Working Directory: .Temp\radiation1720453974066489975tmp Choose...

Columns

☒ Calculate Power Level

Power Level Column: Power Level

☒ Calculate Field Strength

Field Strength Column: Field Strength

☒ Use Height (AGL) Column

Height (AGL) Column: Height

Carrier

☒ Restrict To: WLAN 2.4 GHz

OK Cancel

Figure 295: Point field strength calculation settings for CORLA

3.2.3 Choose a **working directory** for CORLA.

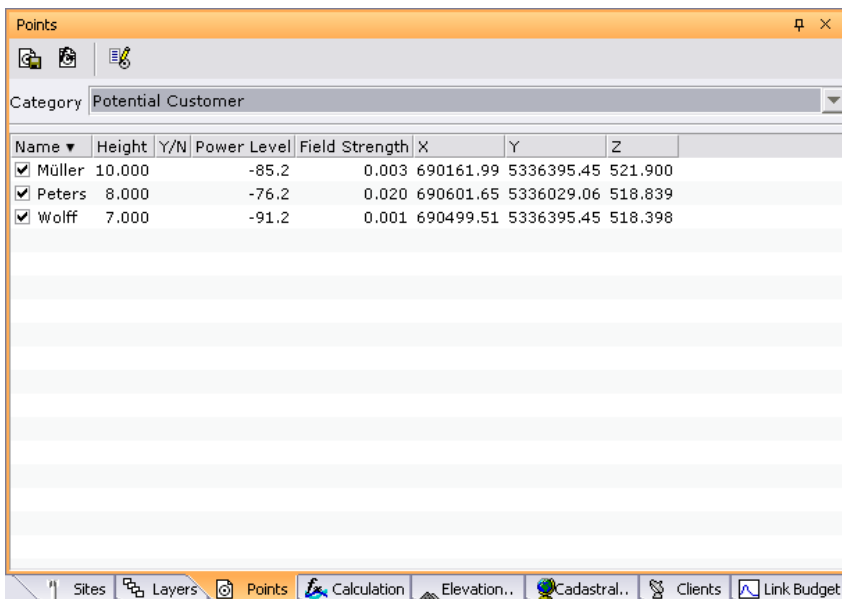
Usually it does not need to be edited. CORLA only needs to create a few temporary files while calculating.



To configure the CORLA Raylauncher, see chapter 3.1.2.3.



Note that the CORLA Raylauncher needs a license for a specific environment and can only be used by Professional-Edition users.



Points

Category: Potential Customer

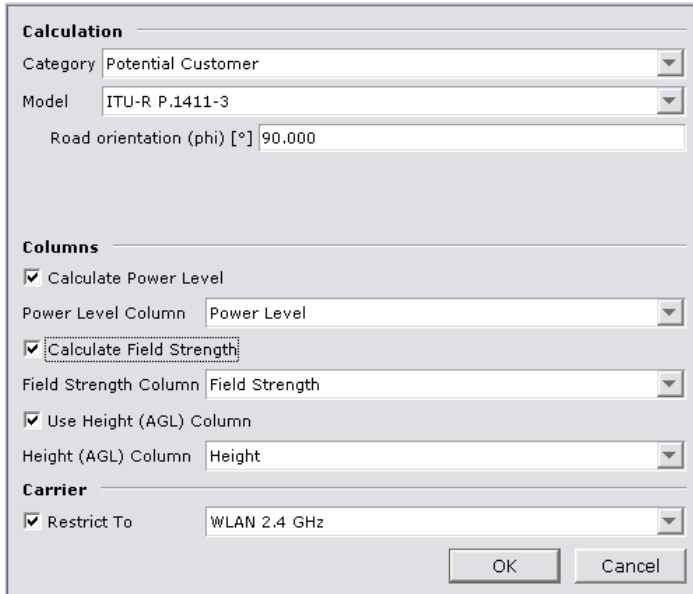
Name	Height	Y/N	Power Level	Field Strength	X	Y	Z
☒ Müller	10.000		-85.2	0.003	690161.99	5336395.45	521.900
☒ Peters	8.000		-76.2	0.020	690601.65	5336029.06	518.839
☒ Wolff	7.000		-91.2	0.001	690499.51	5336395.45	518.398

Sites Layers Points Calculation Elevation.. Cadastral.. Clients Link Budget

Figure 296: A point field strength calculation example:
Munich, CORLA, resolution x/y: 3, resolution z: 3, point extent: 1

10.4.1.3 With the ITU-R P.1411-3 Model

3.3.1 Choose the *average road orientation* in °. This can be set to a standard value in the settings.



Calculation

Category: Potential Customer

Model: ITU-R P.1411-3

Road orientation (phi) [°]: 90.000

Columns

☒ Calculate Power Level

Power Level Column: Power Level

☒ Calculate Field Strength

Field Strength Column: Field Strength

☒ Use Height (AGL) Column

Height (AGL) Column: Height

Carrier

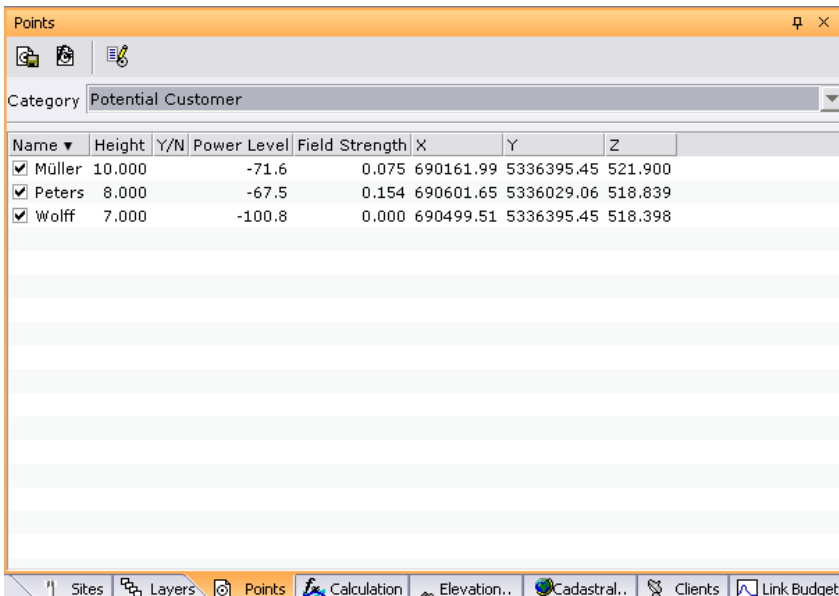
☒ Restrict To: WLAN 2.4 GHz

OK Cancel

Figure 297: Point field strength calculation settings for ITU-R P.1411-3



To configure the ITU-R P.1411-3, see chapter 3.1.2.2.2.



Points

Category: Potential Customer

Name	Height	Y/N	Power Level	Field Strength	X	Y	Z
☒ Müller	10.000		-71.6	0.075	690161.99	5336395.45	521.900
☒ Peters	8.000		-67.5	0.154	690601.65	5336029.06	518.839
☒ Wolff	7.000		-100.8	0.000	690499.51	5336395.45	518.398

Sites Layers Points Calculation Elevation.. Cadastral.. Clients Link Budget

Figure 298: A point field strength calculation example:
Munich, ITU-R P.1411-3, road orientation: 90°

10.4.1.4 With the Free Space Propagation Model

3.4.1 The Free Space Propagation model is the easiest model, it does not need any parameters.

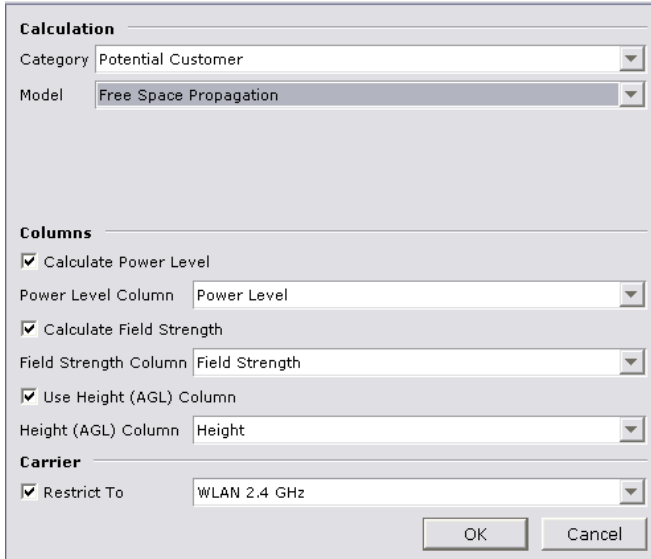
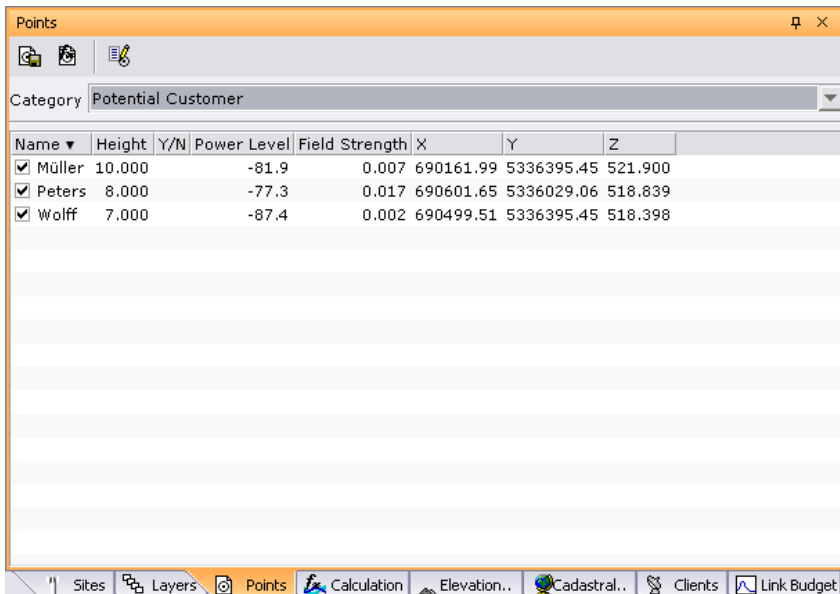


Figure 299: Point field strength calculation settings for Free Space Propagation



To configure the Free Space Propagation Model, see Chapter 3.1.2.2.1.

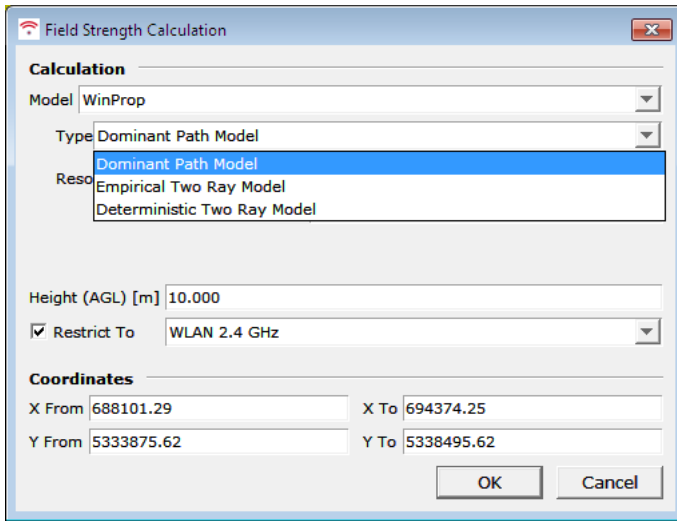


Name	Height	Y/N	Power Level	Field Strength	X	Y	Z
✓ Müller	10.000		-81.9	0.007	690161.99	5336395.45	521.900
✓ Peters	8.000		-77.3	0.017	690601.65	5336029.06	518.839
✓ Wolff	7.000		-87.4	0.002	690499.51	5336395.45	518.398

Figure 300: A point field strength calculation example: Munich, Free Space Propagation

10.4.1.5 With the WinProp

3.5.1 WinProp is for propagation modeling in different scenarios with different model types of calculation.



The image shows a screenshot of the 'Field Strength Calculation' dialog box in WinProp. The 'Calculation' section has 'Model' set to 'WinProp', 'Type' set to 'Dominant Path Model', and 'Reso' set to 'Dominant Path Model'. The 'Height (AGL) [m]' is set to '10.000'. The 'Restrict To' checkbox is checked and set to 'WLAN 2.4 GHz'. The 'Coordinates' section has 'X From' set to '688101.29', 'X To' set to '694374.25', 'Y From' set to '5333875.62', and 'Y To' set to '5338495.62'. There are 'OK' and 'Cancel' buttons at the bottom right.

Figure 301: WinProp Field Strength Calculations settings

3.5.1.1 The **Dominant Path Model** calculate the main paths between transmitter and each receiver pixel by high precision like the ray tracing.

3.5.1.2 The **Okumura-Hata Model** calculate the path loss based on four factor, *frequency* (between 150MHz – 1500MHz), *distance* (1km – 20km between transmitter and receiver), *height of transmitter* (between 30m – 200m), and *height of receiver* (between 1m – 10m).

3.5.1.3 The **Empirical Two Ray Model** calculate the path loss by each pixel on the map, without looking for the point is hidden or unreachable.

3.5.1.4 The **Deterministic Two Ray Model** calculate the path loss by each pixel on the map with checking whether the point is not hidden and reachable.



A special license is needed to use WinProp models, which can be ordered at WIMAP-4G product support.

10.4.1.6 General Settings

4. After choosing and configuring the desired propagation model, there are a few settings that have to be done for all models. The values which should be calculated need to be chosen at the bottom of the window.

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Columns

☒ Calculate Power Level
Power Level Column: Power Level

☐ Calculate Field Strength
Field Strength Column: Field Strength

☒ Use Height (AGL) Column
Height (AGL) Column: Height

Carrier

☒ Restrict To: WLAN 2.4 GHz

OK Cancel

Figure 302: General settings for point field strength calculation

Make sure to *assign the calculated **value** to the correct point category column*. For the height column, choose the height column that is used from the points. Do not use the Z column because this will distort the results.

5. At last, choose the carrier for the calculation and press **OK** to start the calculation.

10.4.2 Compare all Propagation Models

With the help of the point categories it is also possible to compare the propagation models. A propagation model may give good results whereas another does not offer good results for the special case. With some modifications the results of all propagation models can be compared to make a decision.

10.4.2.1 How to Use all Propagation Models for a Point Field Strength Calculation

1. Choose **Points**→**Edit Categories**.



Points Clients Link Calcu

Create...
Edit Multiple...
Export...
Import...
Activation
Edit Categories...

Name ▼
Potential Customer
potential customer

New...
Edit...
Delete
Options

Close

Figure 303: Open the point category settings

2. Choose the desired point category (in this case Potential Customer was chosen). Add columns for all propagation models.



To edit point classes see chapter 9.1.1 and 9.1.2.

3. The result should look like this:

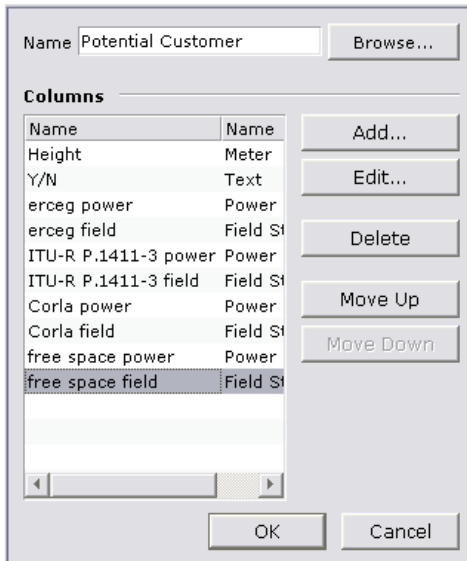


Figure 304: Columns for all propagation models

4. Click on **OK**, close all windows and return to the project.

5. Choose **Calculation→Point Field Strength Calculation** and make a calculation for every model.

Make sure to choose the right column at the bottom of the window and start the calculations.

Calculation

Category Potential Customer

Model Erceg Model

Type Erceg C

(Flat/light tree density)

Coverage Probability [%] 50.00

Columns

☒ Calculate Power Level

Power Level Column erceg power

☒ Calculate Field Strength

Field Strength Column erceg field

☒ Use Height (AGL) Column

Height (AGL) Column Height

Carrier

☒ Restrict To WLAN 2.4 GHz

OK Cancel

Calculation

Category Potential Customer

Model ITU-R P.1411-3

Road orientation (phi) [°] 90.000

Columns

☒ Calculate Power Level

Power Level Column ITU-R P.1411-3 power

☒ Calculate Field Strength

Field Strength Column ITU-R P.1411-3 field

☒ Use Height (AGL) Column

Height (AGL) Column Height

Carrier

☒ Restrict To WLAN 2.4 GHz

OK Cancel

Calculation

Category Potential Customer

Model CORLA (Raylauncher)

Resolution X/Y [m] 3.000 Resolution Z [m] 3.000

Point Extent (multiple of Resolution X/Y) 1

Working Directory .Temp\radiation8357289087596807164tmp Choose...

Columns

☒ Calculate Power Level

Power Level Column Corla power

☒ Calculate Field Strength

Field Strength Column Corla field

☒ Use Height (AGL) Column

Height (AGL) Column Height

Carrier

☒ Restrict To WLAN 2.4 GHz

OK Cancel

Calculation

Category Potential Customer

Model Free Space Propagation

Columns

☒ Calculate Power Level

Power Level Column free space power

☒ Calculate Field Strength

Field Strength Column free space field

☒ Use Height (AGL) Column

Height (AGL) Column Height

Carrier

☒ Restrict To WLAN 2.4 GHz

OK Cancel

Figure 305: Make point field strength calculations for every propagation model

6. All columns are shown in the points tab of the Project-Explorer. Results can be compared after doing all calculations.

Points										
List Coverage Visualisation										
Category Potential Customer										
Name	...	Corla power	Corla field	ITU-R P.1411-3 power	ITU-R P.1411-3 field	free space power	free sapce fi...	erceg po...	erceg fi...	X
☒ Müller		-92.2	0.001	-83.7	0.005	-91.5	0.001	-105.8	0.000	690161.99
☒ Peters ...		-85.2	0.003	-112.7	0.000	-82.2	0.006	-99.5	0.000	690601.65
☒ Wolff ...		-104.2	0.000	-108.4	0.000	-81.8	0.006	-94.2	0.000	690499.51

Figure 306: Compare the propagation models

10.5 The Site to Site Calculation

The **site to site calculation** feature calculates the pathloss between two antennas. This can be useful to determine whether two antennas can cooperate in a specific area or not.



10.5.1 How to Make a Site to Site Calculation

There are a few requirements to make a site to site calculation successful. Possibly the most common reason to get a bad result or no result in a site to site calculation is when both antennas use the same carrier. Another source of error is the angle between two antennas.

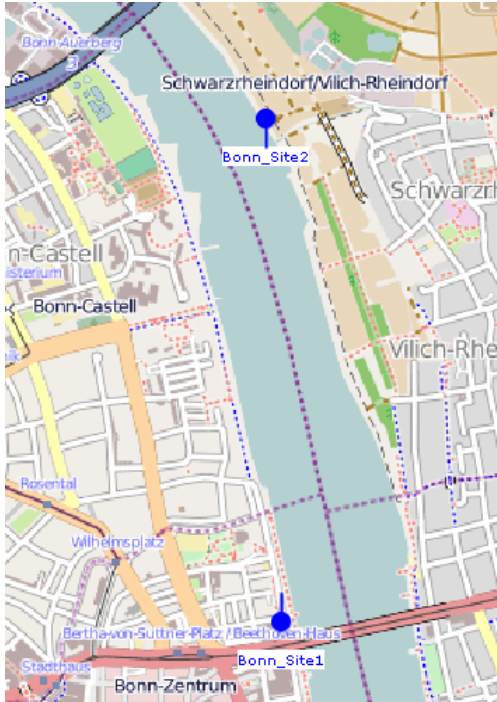


Figure 307: Example sites

1. There are two possibilities to make a site to site calculation:

- Choose **Calculation→Site-to-Site**.

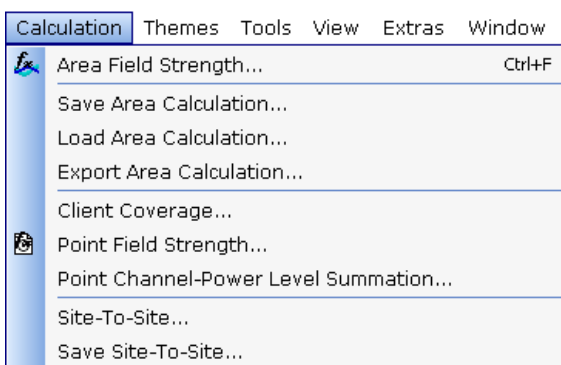


Figure 308: Start Site-to-Site calculation

- Right click on a site on the map and choose **Site-to-Site Calculation**.

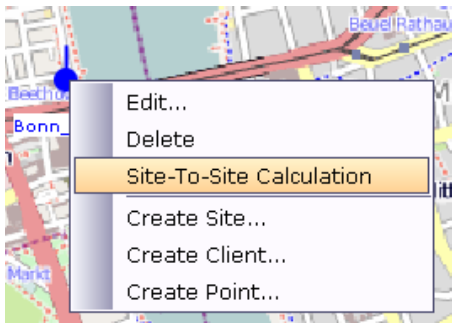


Figure 309: Start Site-to-Site calculation from the map

2. The Site-to-Site calculation window opens:

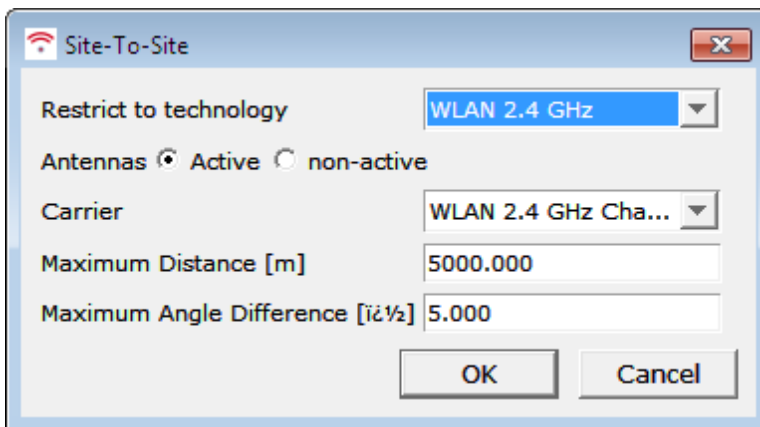


Figure 310: The Site-to-Site calculation settings

3. Choose the **technology** and **carrier** used by the desired antennas, select if the antennas **active** or **non-active** and insert **maximum distance** and **maximum angle difference** and click on **OK**.

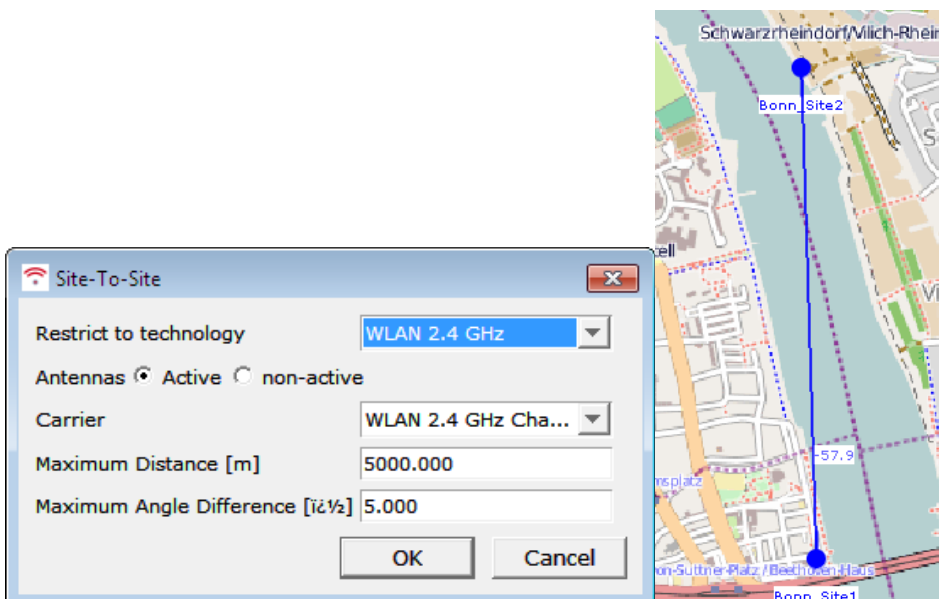


Figure 311: Fill in all the fields and click OK to start the calculation

The pathloss will be shown beside the line which connects the antennas. In this case it is -57.9 dB.

Figure 312 shows a few antennas involved in a site to site calculation. If a blue line connects antennas after doing a site to site calculation, everything worked out fine. If a black line is shown, the antenna is not placed well. Take a look at the environment with the help of the **Terrain-Profiler** to find out what happened. In most cases a mountain or a building interferes the connection.

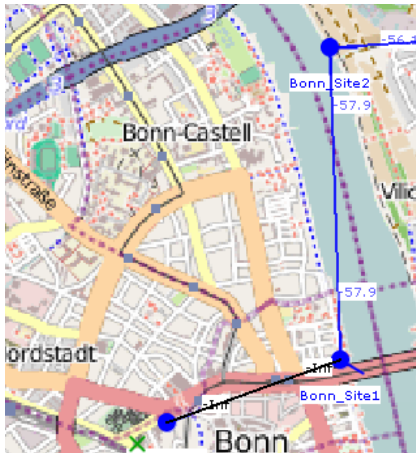


Figure 312: A black line signalizes problems

10.6 The Coverage Theme

This theme is the basic theme used by the field strength area calculation. The coverage theme provides a margin that can be determined for the project. It is a useful feature to run some tests to find out how the coverage changes, using different margins.



Note that the coverage theme will be created at the height the field strength area calculation was made.



10.6.1 How to Create a Coverage Theme

1. Make a field strength area calculation.

(A more precise calculation offers a better overview but takes more time to calculate.)



To make a field strength area calculation see chapter 10.2.1.

2. There are three possibilities to create a coverage theme:

- Choose **Themes→Coverage→Display**.

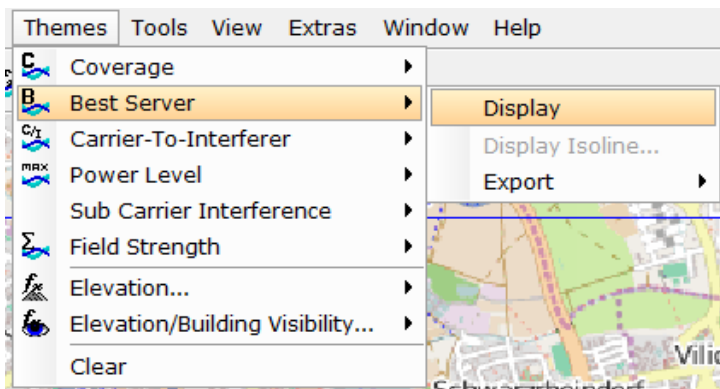


Figure 313: Create coverage theme from menu

- Choose the **calculation tab** in the **Project-Explorer** and click on  .

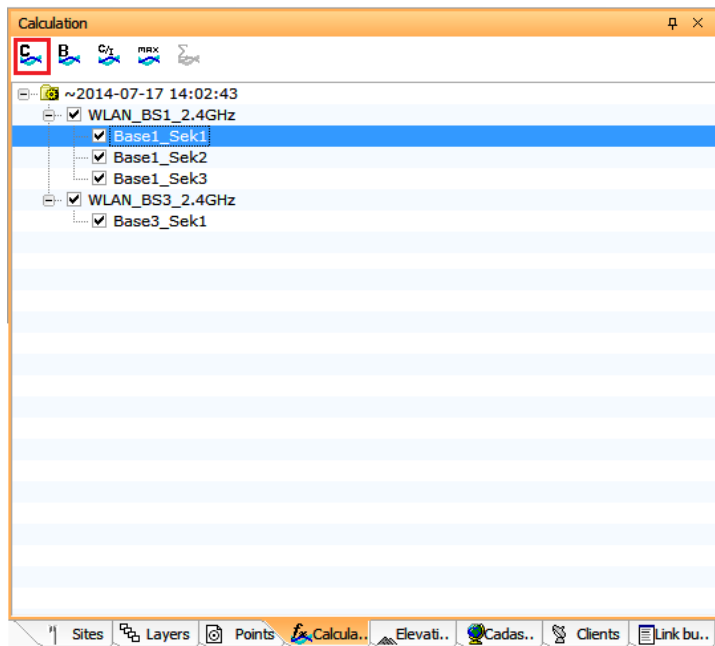


Figure 314: Create coverage theme from calculation tab

- Choose the **calculation tab** in the **Project-Explorer**, right click and choose **Coverage**.

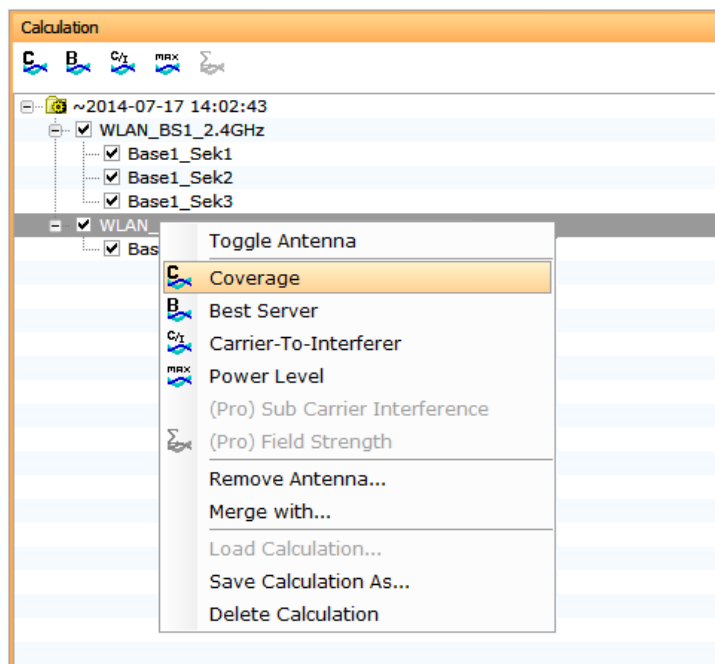
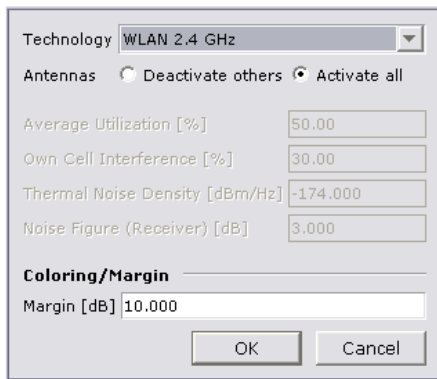


Figure 315: Create coverage theme from calculation tab by right-clicking antennas

3. The coverage theme window opens:



Technology: WLAN 2.4 GHz

Antennas: ☐ Deactivate others ☒ Activate all

Average Utilization [%]: 50.00

Own Cell Interference [%]: 30.00

Thermal Noise Density [dBm/Hz]: -174.000

Noise Figure (Receiver) [dB]: 3.000

Coloring/Margin

Margin [dB]: 10.000

OK Cancel

Figure 316: Coverage theme settings

4. Choose to create the theme for *all antennas* or only the *actual antenna*.

(Only works by right clicking on antennas in the **Project-Explorer** and choosing **Coverage** or marking the antennas and clicking on ). WiMAP-4G will automatically assign the grayed values.

5. Choose a *margin* and click on **OK.**

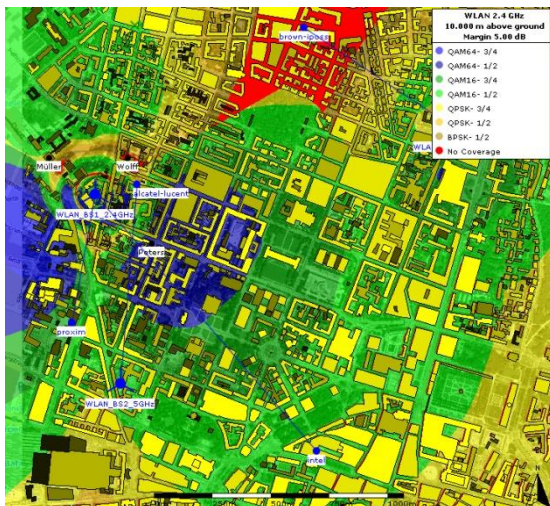


Figure 317: A coverage theme example: Munich, 10dB margin

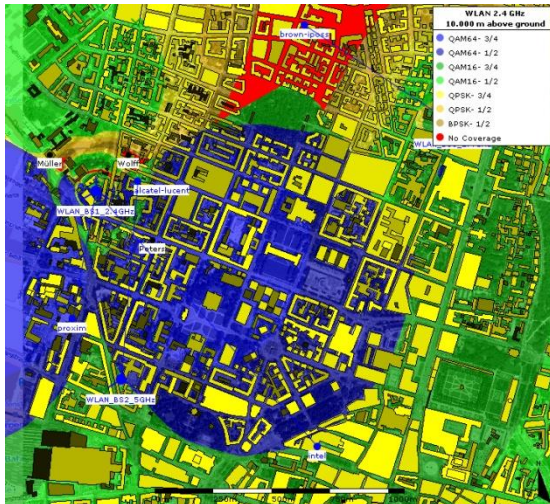


Figure 318: A coverage theme example: Munich, 0dB margin

10.7 The Best Server Theme

Learned from its name, the best server theme shows the antenna that offers the best signal for a specific area. In most cases, the nearest antenna is not the best choice for a customer. A few circumstances, for example, the environment and the buildings need to be considered while calculating the best antenna. WiMAP-4G offers the best server theme to maintain the best signal for a specific area. The best server theme needs a field strength area calculation to offer results.



Note that the best server theme will be created at the height, the field strength area calculation was made.



10.7.1 How to Create a Best Server Theme

1. Make a field strength area calculation.

(A more precise calculation offers better overview but takes more time to calculate.)



To make a field strength area calculation see chapter 10.2.1.

2. There are three possibilities to create a best server theme:

- Choose **Themes→Best Server→Display**.

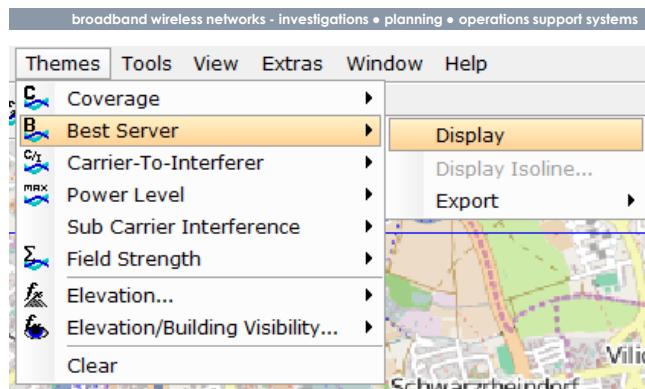


Figure 319: Create best server theme from menu

- Choose the **calculation** tab in the **Project-Explorer** and click on .

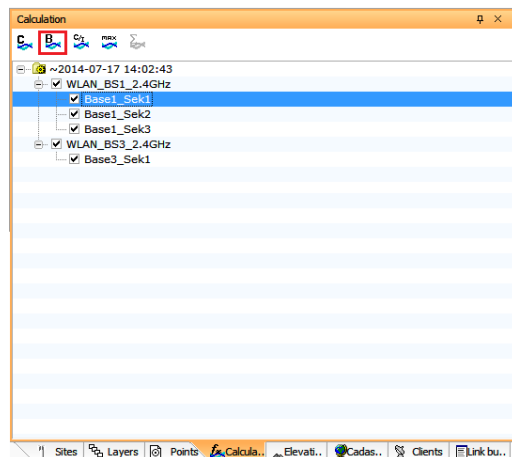


Figure 320: Create best server theme from calculation tab

- Choose the **calculation** tab in the **Project-Explorer**, right-click and choose **Best Server**.

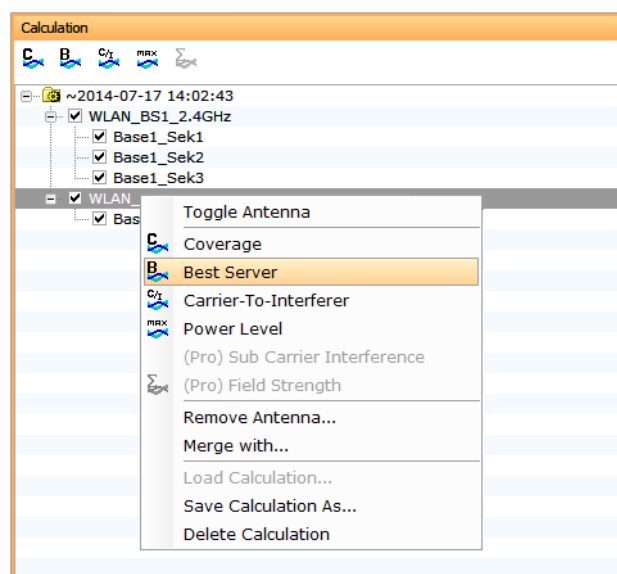


Figure 321: Create best server theme from calculation tab by right-clicking antennas

3. The best server theme window opens:

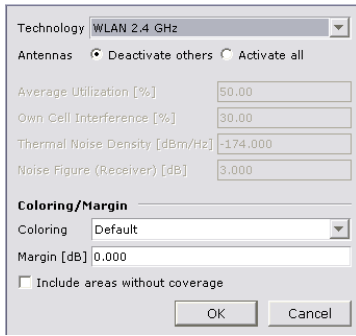


Figure 322: Best server theme settings

4. Choose to create the theme for **all antennas** or only the **actual antenna**.

(Only works by right clicking on antennas in the Project-Explorer and choosing **Best Server** or marking the antennas and clicking on .)

5. Choose a **color profile** and a **margin**.

Including areas without coverage force WiMAP-4G to calculate the theoretical best server for that area assuming there would be coverage. (If the **included area without coverage** option is enabled, the **margin** will be ignored.)



To change color profiles, see chapter 3.1.2.1.1.

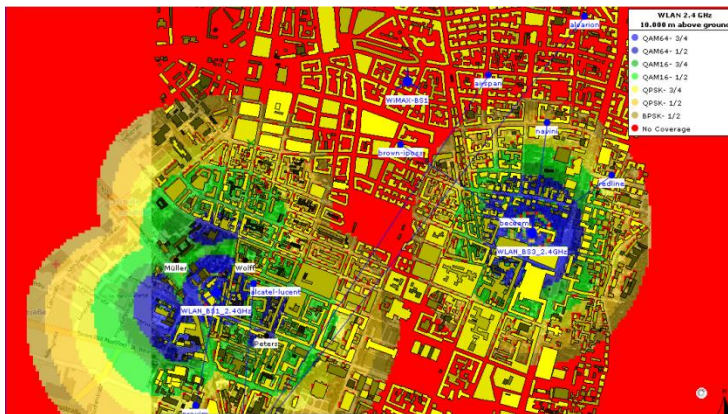


Figure 323: Munich: Field strength area calculation Erceg A



Figure 324: A best server theme example: Munich, 10dB margin

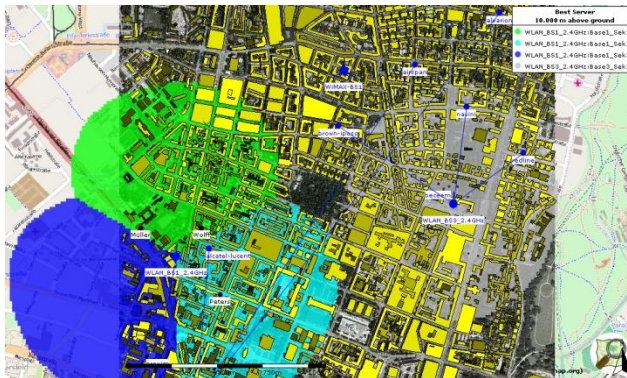


Figure 325: A best server theme example: Munich, 0dB margin

10.8 The Carrier to Interferer Theme

The **carrier to interferer theme** is a useful feature of WiMAP-4G to detect not covered areas on the map because of interference between antennas. If two antennas use the same carrier at the same frequency and power, they interfere each other. This could end in a complete signal loss. WiMAP-4G shows the ratio between carrier signal and interference signal. The minimal value acceptable as a result of a carrier to interference theme depends on the used technology. Areas that offer a carrier to interference below 0 mostly do not receive a useable signal. For example, for LTE and a QAM64 modulation a minimum ratio of 10 is required.



Note that the carrier to interferer is based on the field strength area calculation done before and is limited to its parameters (e.g. calculation height).



10.8.1 How to Create a Carrier to Interferer Theme

1. *Make a field strength area calculation.*

(A more precise calculation offers better overview but takes more time to calculate.)



To make a field strength area calculation see chapter 10.2.1.

2. There are three possibilities to create a carrier to interferer theme:

- Choose **Themes**→**Carrier to Interferer**→**Display**.

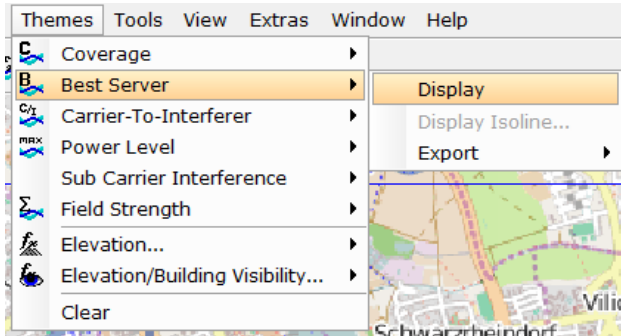


Figure 326: Create carrier to interferer theme from menu

- Choose the **calculation tab** in the **Project-Explorer** and click  .

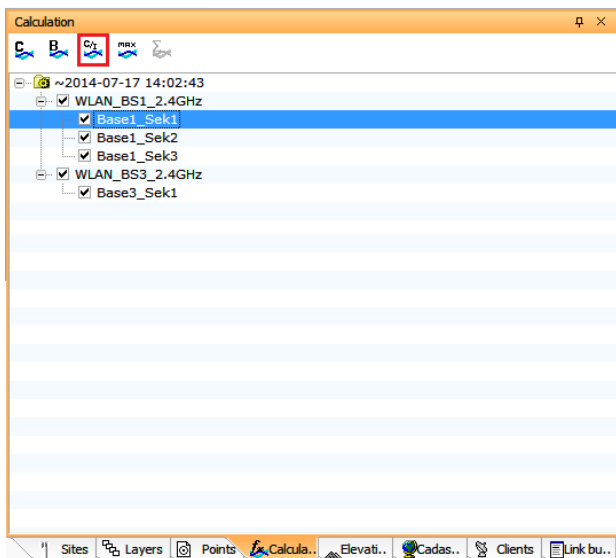


Figure 327: Create carrier to interferer theme from calculation tab

- Choose the **calculation tab** in the **Project-Explorer**, right-click and choose **Carrier To Interferer**.

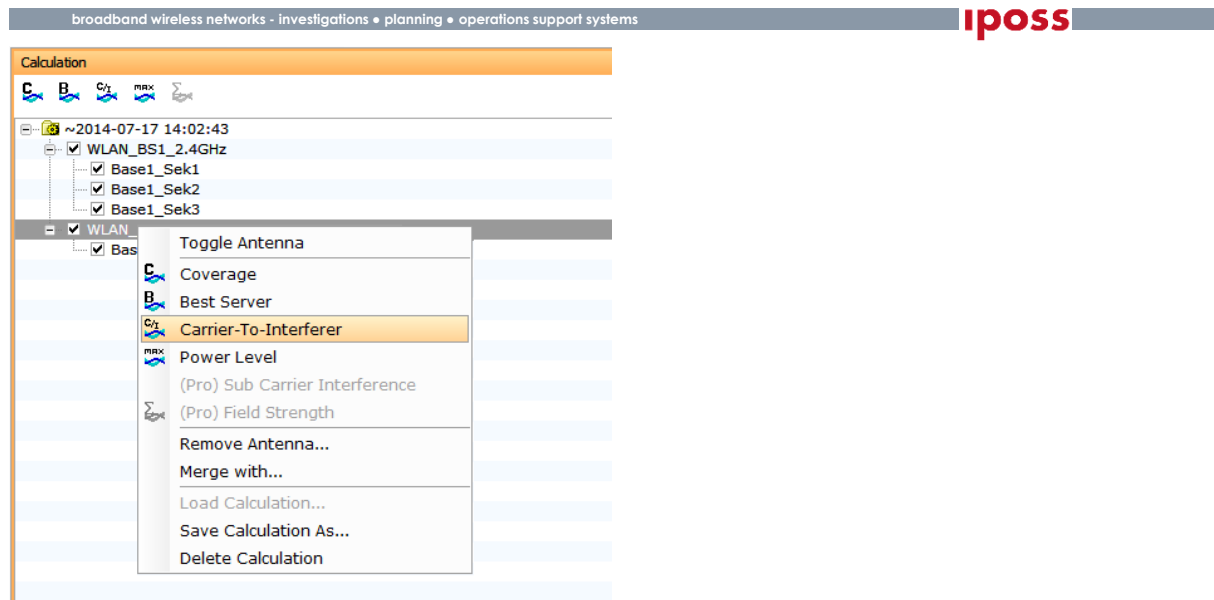


Figure 328: Create carrier to interferer theme from calculation tab by right-clicking antennas

3. The carrier to interferer theme window opens:

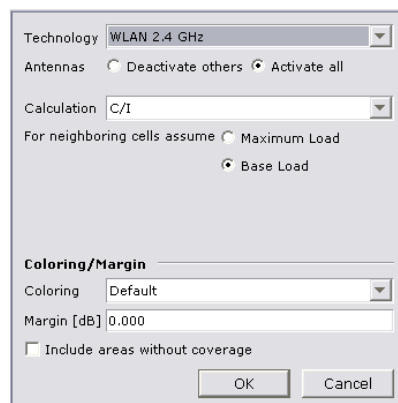


Figure 329: Carrier to interferer theme settings

4. Choose to create the theme for **all antennas** or only the **actual antenna**.

(Only works by right clicking on antennas in the Project-Explorer and choosing Carrier to Interferer or marking the antennas and clicking on  .)

5. Choose a **color profile** and a **margin**.



To change color profiles, see chapter 3.1.2.1.1.

The sites can run in maximum load or base load modus during a calculation.
Choose one of them.

The maximum load is default because in extreme situations the ratio is always more significant than it would be in base load situations. Including areas without coverage forces WiMAP-4G to show the theoretical carrier to interferer value for an area assuming there would be coverage. (If the include area without coverage option is enabled, the margin will be ignored.)

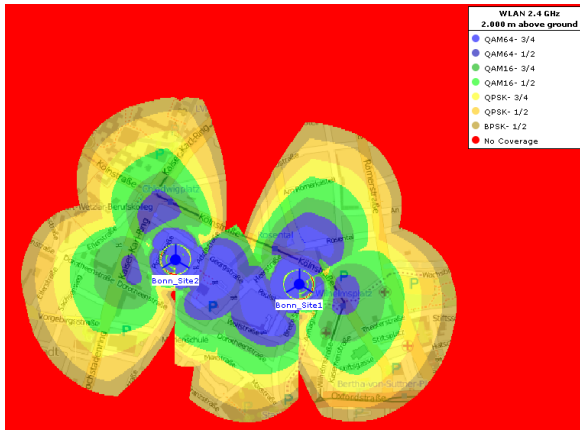


Figure 330: Field strength area calculation Erceg A

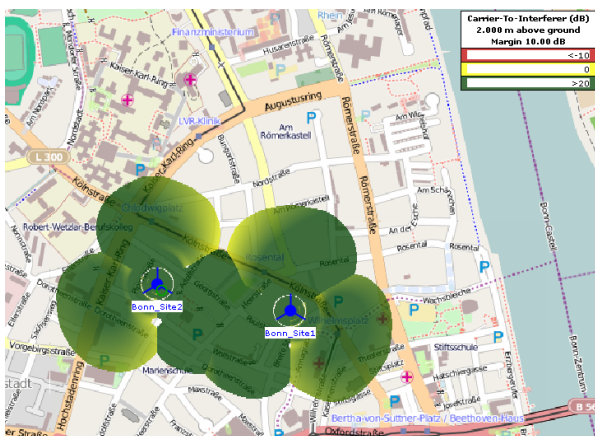


Figure 331: A carrier to interferer theme example: 10 dB margin

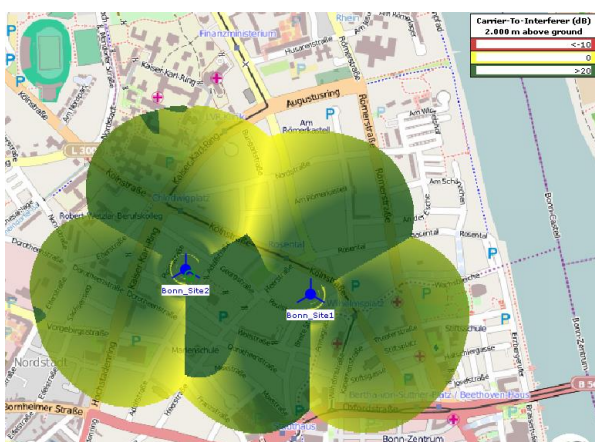


Figure 332: A carrier to interferer theme example: 0 dB margin

As described in the legend, the yellow areas on the map do not have a usable signal. Green zones are more efficient.

A little green circle on the map marks the area with the best carrier to interference ratio.
Drag the mouse cursor over that circle to show the ratio.

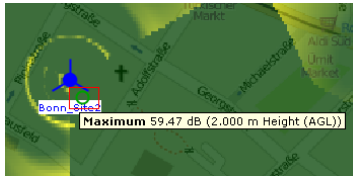


Figure 333: The best C/I is marked with a green circle on the map

10.9 The Power Level Theme

The **power level theme** helps to determine the exact values for the power level in specific areas. Another way to show those values are points used to calculate the power level. Points only show the power level on a precise point on the map whereas the power level theme shows the power level for all zones that are covered by a carrier.



Note that the power level theme will be created at the height the field strength area calculation was made.



10.9.1 How to Create a Power Level Theme

1. *Make a field strength area calculation.*

(A more precise calculation offers a better overview but takes more time to calculate)



To make a power field strength area calculation see chapter 10.2.1.

2. There are three possibilities to create a power level theme:

- Choose **Themes→Power Level→Display**.

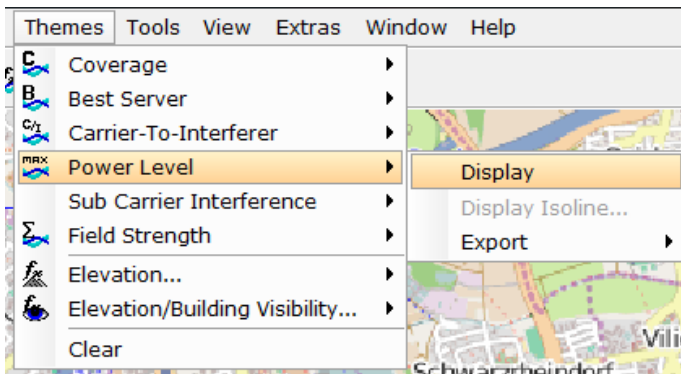


Figure 334: Create power level theme from menu

- Choose the **calculation tab** in the **Project-Explorer** and click on  .

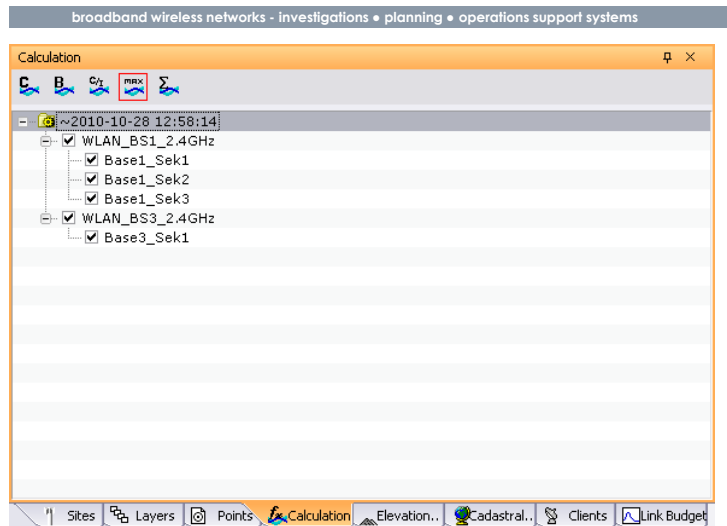


Figure 335: Create power level theme from calculation tab

- Choose the **calculation tab** in the **Project-Explorer**, right click and choose **Power Level**.

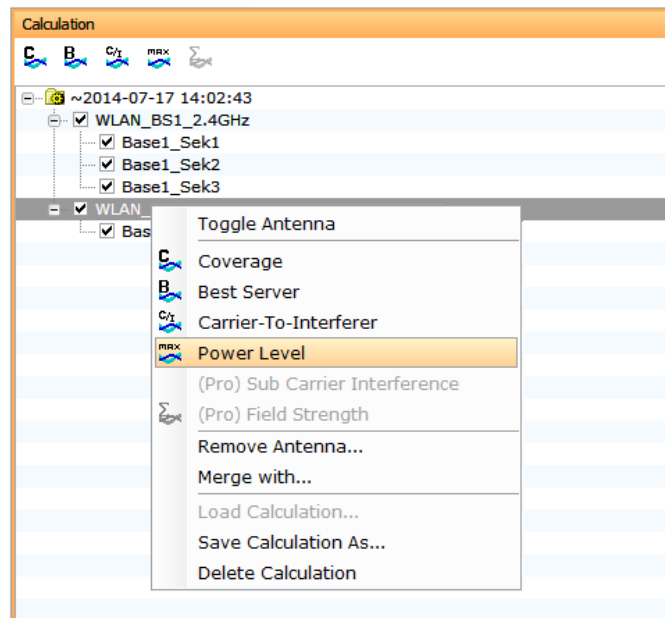


Figure 336: Create power level theme from calculation tab by right-clicking antennas

3. The power level theme window opens:

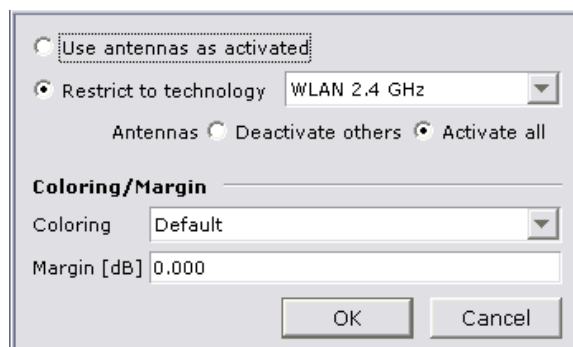


Figure 337: Power level theme settings

4. Choose to create the theme for **all activated antennas** or only a **specific technology**. If the theme is restricted to a specific technology, choose whether the actual antenna or all antennas with that technology should be shown (only works with right-clicking on antennas in the Project-Explorer and choosing Power Level or choosing antenna and clicking ).

5. Choose a *color profile* and a *margin*.



To change the color profiles, see chapter 3.1.2.1.1.

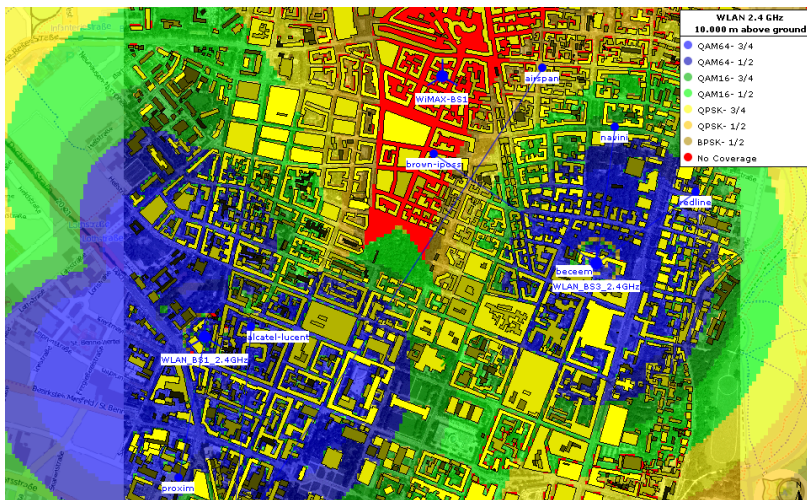


Figure 338: Munich: Field strength area calculation Erceg A



Figure 339: A power level theme example: Munich, 10 dB margin



Figure 340: A power level theme example: Munich, 0 dB margin

In this example, the color profile has been modified to visualize the differences. A little green circle on the map marks the area with the best power level.

Drag the mouse cursor over that circle to see the exact power.



Figure 341: The best power level is marked with a green circle on the map

10.10 The Sub Carrier Interference Theme

The Sub Carrier Interference theme is a useful tool to explore the interference for any activated sub-carrier in the project. The primary benefit is to see the Sub Carrier Interference of the strongest received signal from an antenna carrying the selected sub-carrier to any in-band interferer in the area of comparison. E.g. if WLAN 2.4 GHz Channel 1 is the selected sub-carrier also interferences from overlapping channels like channel 2 are considered. This feature helps to create a clear footprint for your covering cells.



Note that the Sub Carrier Interference theme is created at the height the field strength area calculation was made.



10.10.1 How to Create a Sub Carrier Interference Theme

1. *Make a field strength area calculation.*

(A more precise calculation offers better overview but takes more time to calculate.)



To make a field strength area calculation see chapter 10.2.1.

2. There are two possibilities to create a Sub Carrier Interference theme:

- Choose **Themes**→**Sub Carrier Interference**→**Display**.

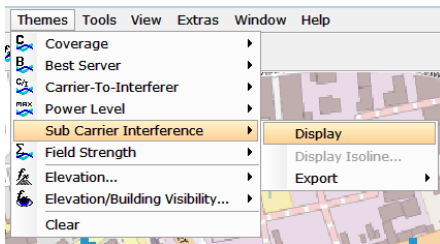


Figure 342: Create Sub Carrier Interference theme from menu

- Choose the **calculation tab** in the **Project-Explorer**, right click and choose **Sub Carrier Interference**.

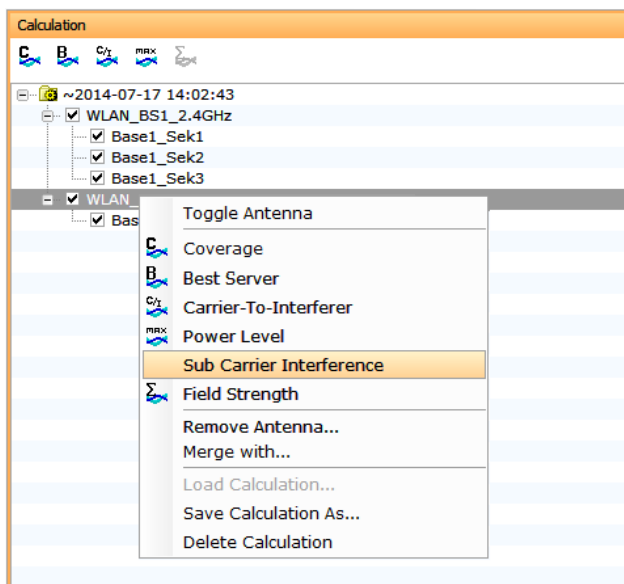


Figure 343: Create Sub Carrier Interference theme from calculation tab by right-clicking antennas

2. The Sub Carrier Interference theme window opens:

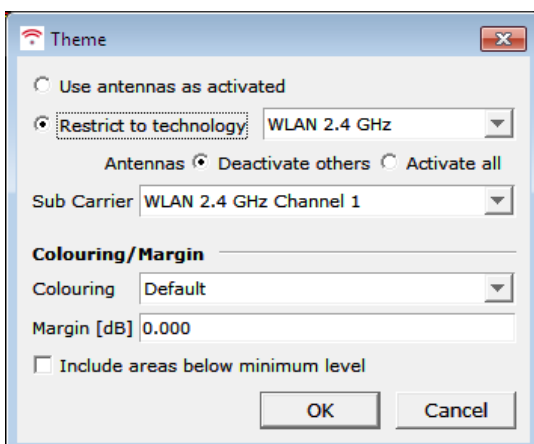


Figure 344: Sub Carrier Interference theme settings

3. Choose to create the theme for *all activated antennas* or only a *specific technology*. If the theme is restricted to a specific technology, choose whether the actual antenna or all antennas with that technology should be shown (only works with right-clicking on antennas in the Project-Explorer and choosing Sub Carrier Interference). Key for this theme is to select the **Sub-Carrier** accordingly.

4. Choose a **colour profile**.



To change colour profiles, see chapter 3.1.2.1.1.

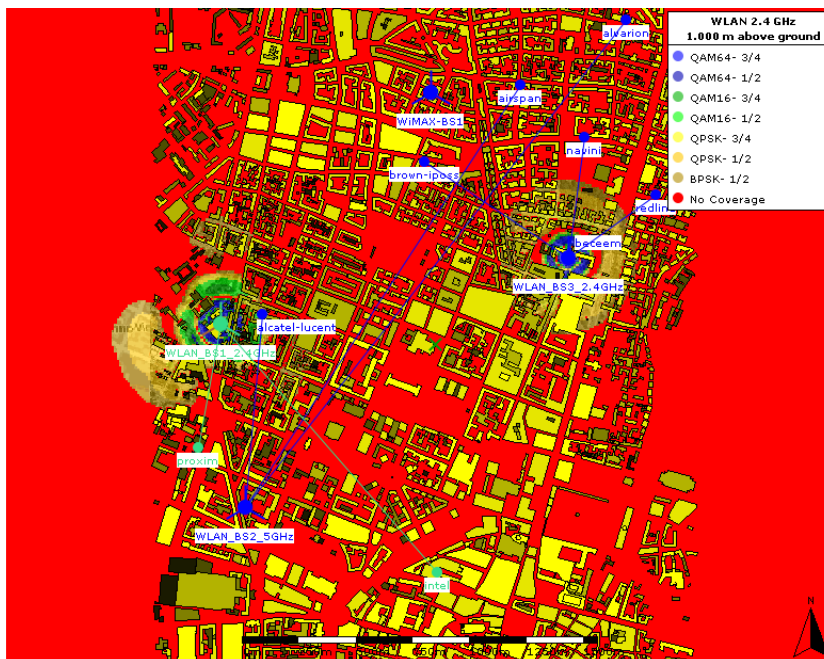


Figure 345: Munich: Field strength area calculation Erceg A

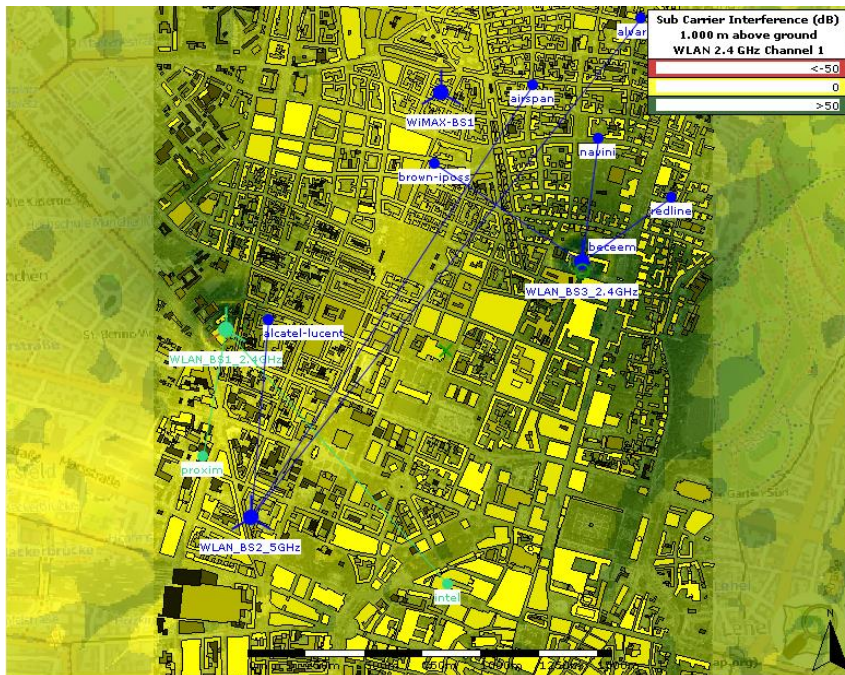


Figure 346: A Sub Carrier Interference theme example: Munich, 0 dB margin

As shown in Figure 346 most of the area is shaded in light green which does mean that the signal for sub-carrier "WLAN 2.4GHz Channel 1" is not too much faced with interference. In contrary to the carrier-to-interference the whole consideration is done for the selected sub-carrier (independent of being the sub-carrier of the best server or not). With the help of this theme easily areas of high interference for a given sub-carrier and its carrying frequency can be explored.

A little green circle on the map marks the area with the best Sub Carrier Interference. Drag the mouse cursor over that circle to see the exact power.



Figure 347: The best Sub Carrier Interference is marked with a green circle on the map

10.11 The Field Strength Theme

The **field strength theme** is useful to determine for example the power density in a specific area around antennas. This can be used to see if the power density fulfills the conditions given by the specific environment. A high power density can cause damage on human health so a power density theme should always be made to check out the field strength and to see if the critical values do not get exceeded.



Note that the field strength theme is created at the height the field strength area calculation was made.



10.11.1 How to Create a Field Strength Theme

1. Make a field strength area calculation.

(A more precise calculation offers better overview but takes more time to calculate.)



To make a field strength area calculation see chapter 10.2.1.

2. There are three possibilities to create a field strength theme:

- Choose **Themes**→**Field Strength**→**Display**.

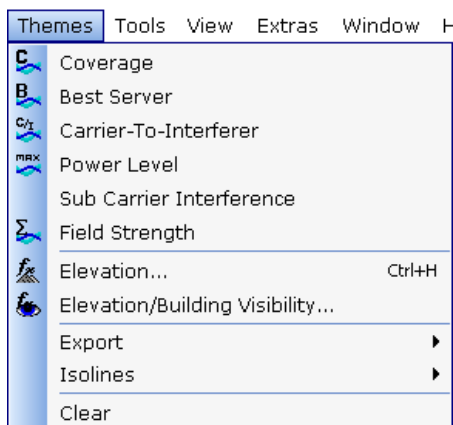


Figure 348: Create field strength theme from menu

- Choose the **calculation tab** in the **Project-Explorer** and click .

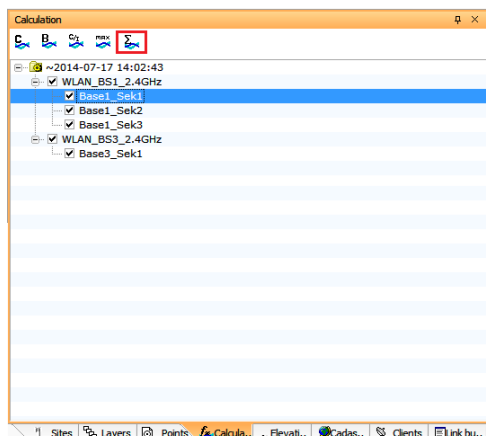


Figure 349: Create field strength theme from calculation tab

- Choose the **calculation tab** in the **Project-Explorer**, right click and choose **Field Strength**.

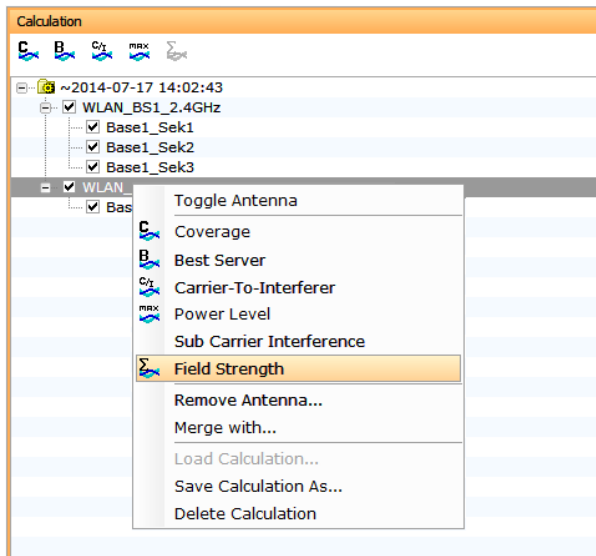


Figure 350: Create field strength theme from calculation tab by right-clicking antennas

3. The field strength theme window opens:

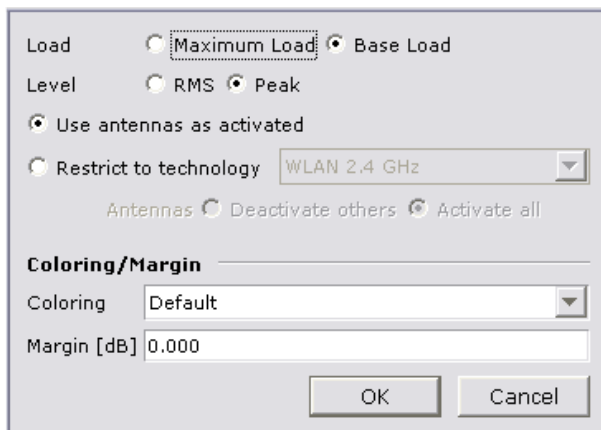


Figure 351: Field strength theme settings

4. Choose the **maximum load** or the **base load** to be used for the theme.
The maximum load is recommended to see results in extreme situations.

5. Choose **RMS** (root mean square) or **peak level** to be used.
Peak level is recommended to see results in extreme situations.

6. Choose to create the theme for **all activated antennas** or only a **specific technology**.
If the theme is restricted to a specific technology, choose whether the actual antenna or all antennas with that technology should be shown (only works with right clicking on antennas

in the Project-Explorer and choosing Field Strength Calculation or choosing antenna and clicking).

7. Choose a **colour profile** and a **margin**.



To change colour profiles, see chapter 3.1.2.1.1.

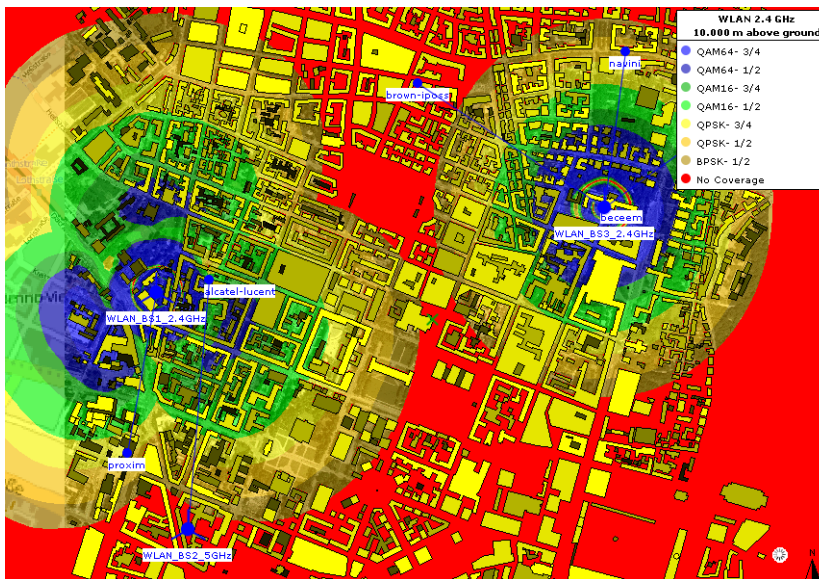


Figure 352: Munich: field strength area calculation Erceg A

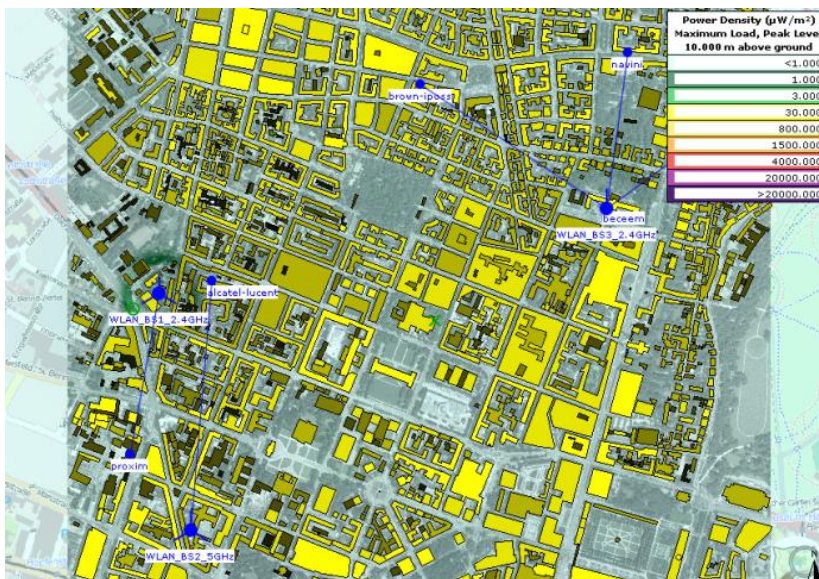


Figure 353: A field strength theme example: Munich, 0 dB margin, maximum load, peak level



Figure 354: A field strength theme example: Munich, 10 dB margin, maximum load, peak level

In our demo-project Munich everything works fine and most of the area has a power density $< 1 \mu\text{W}/\text{m}^2$.

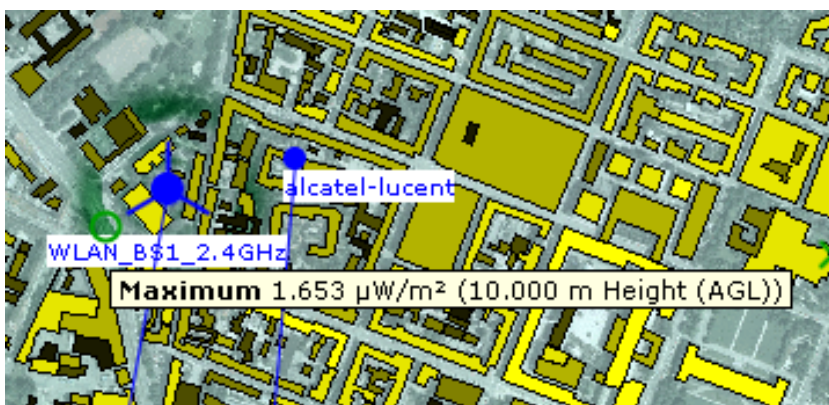


Figure 355: The best field strength is marked with a green circle on the map

A little green circle on the map marks the area with the highest power density. *Drag the mouse cursor over that circle to show the exact power density.*

10.12 The Elevation Theme

The elevation theme shows all the elevation differences in the terrain and therefore it is useful for presentations and for a better overview. It is also useful in the beginning of a project when the antennas and sites are placed. Environmental interferers like mountains aren't visible without an elevation theme. The elevation theme can be used to create isolines for the desired terrain. These isolines can be exported into other programs for example Google earth for a better presentation.



An elevation model is required for the elevation theme. For more information see chapter 4.2.



10.12.1 How to Create an Elevation Theme

1. *Import an elevation model.*

2. *Choose **Themes**→**Elevation**→**Display**.*

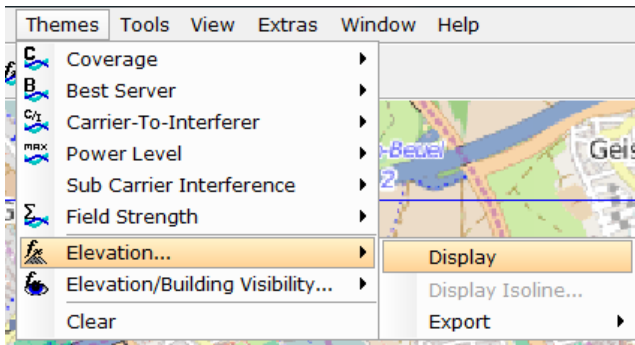


Figure 356: Create elevation theme from menu

3. The elevation theme window opens and some settings have to be done.

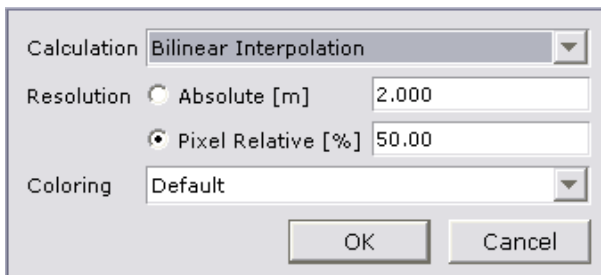


Figure 357: Elevation theme settings

Choose whether to use the **bilinear interpolation** or the **nearest neighbor** algorithm for the theme.



The bilinear interpolation is a much more precise algorithm and under no special circumstances it should be used. The nearest neighbor algorithm is really imprecise but therefore the system requirements for this algorithm are very low.

The **resolution** can be chosen between **absolute** or **relative**.

Finally a **colour profile** needs to be set.



To change colour profiles, see chapter 3.1.2.1.1.

4. Press **OK** to create the theme.

In our example, the colour profile has been changed for a better overview.

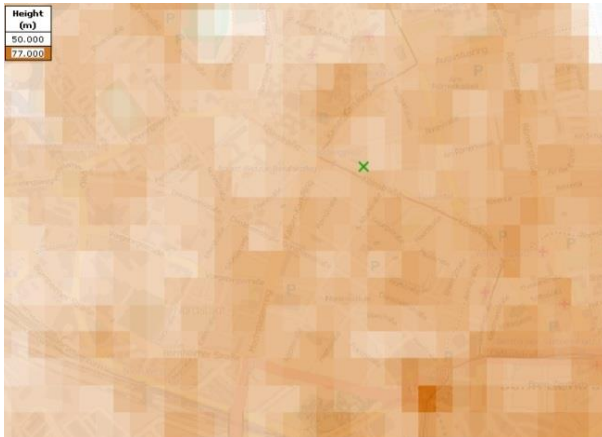


Figure 358: Elevation theme example, nearest neighbor, resolution relative 100 %



Figure 359: Elevation theme example, bilinear interpolation, resolution relative 100%

10.12.2 Clear the Elevation Cache

The elevation layer can be cleared separately. This avoids the loss of all calculation data if the user only want to delete the elevation cache.



10.12.2.1 How to Clear the Elevation Cache

1. Choose **Themes→Clear**.

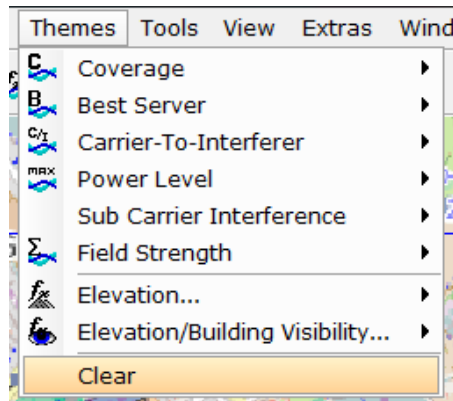


Figure 360: Clear elevation cache



This will delete the whole theme from the project. Keep in mind that the theme cannot be returned and that this operation cannot be reverted. Time consuming calculations may have to be made again.



The more elegant way to hide themes is to deactivate the corresponding layers in the layer tab. For more information about layers, layer activation and deactivation, see chapter 2.5.2.

10.13 The Visibility Theme

The **visibility theme** shows the visibility of a point in the users current view. With the help of this theme, the user can check the line of sight between two locations on the map. This can help to determine the exact coordinates for a site in ought to be planned. In addition, the visibility theme will take account for both the elevation attenuation and buildings if there is no line of sight between the chosen points.



An elevation model is required to create a visibility theme. For more information see chapter 4.2.



10.13.1 How to Create a Visibility Theme

1. Import an elevation model.

That would be the only thing that is required for a visibility theme.

2. Choose **Themes**→**Elevation/Building Visibility**→**Display**.

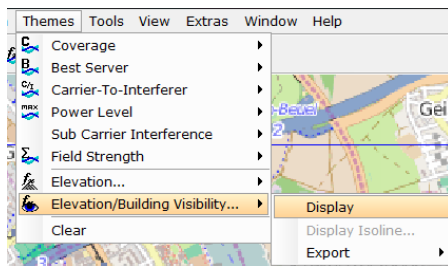


Figure 361: Create visibility theme

3. The visibility theme window opens and some settings have to be done.

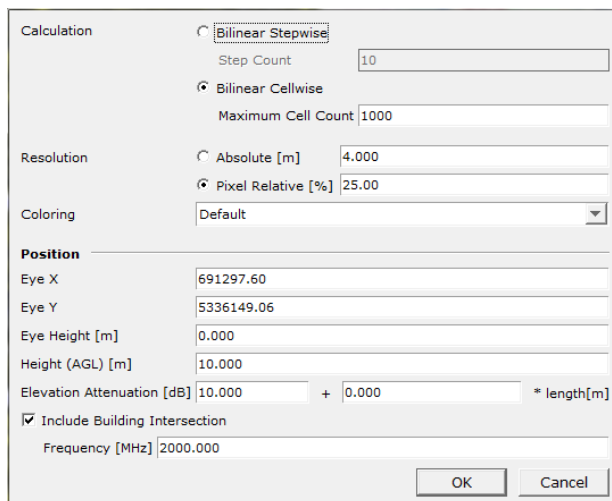


Figure 362: Visibility theme settings

Choose whether to use **bilinear cell-** or **stepwise** for the theme. Enter a value for the chosen technique and change the **resolution** to your needs. The **resolution** can be absolute or relative. At last, a **color profile** needs to be set.



To change the color profiles, see chapter 3.1.2.1.1.

4. Make some position settings to meet your special case.

- **EYE X:** The x-coordinate of the imaginary eye.
- **EYE Y:** The y-coordinate of the imaginary eye. These coordinates are set to the position of the cursor, by default.
- **Eye Height** specifies the height of the imaginary eye above the ground.
- **Height (AGL)** specifies the height above the ground onto which the imaginary eye looks.

- **Elevation Attenuation** specifies the attenuation that is considered in case of NLOS.
- **Include Building Intersection** considers visibility restrictions arising from the building model.
- In this case, a **frequency** needs to be specified for the special case.

5. Press **OK** to create the theme.

In our example, the color profile has been changed for a better overview.



Figure 363: Visibility theme example, bilinear cellwise 1000, resolution relative 100 %



10.13.1.1 How to Clear the Visibility Cache

1. Choose **Themes→Clear**.

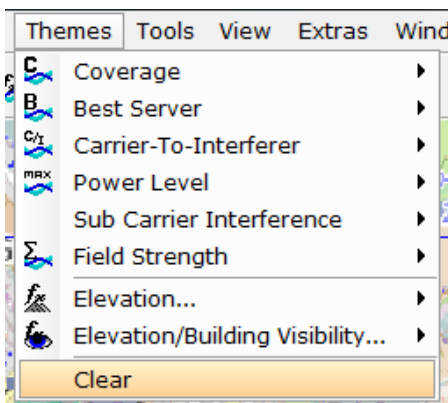


Figure 364: Clear the visibility layer



This will delete the whole theme from the project. Keep in mind that the theme cannot be returned and that this operation cannot be reverted. Time consuming calculations may have to be made again.



The more elegant way to hide themes is to deactivate the corresponding layers in the layer tab. For more information about layers, layer activation and deactivation, see chapter 2.5.2.

10.14 Export Calculation Theme

Export is an extension of the Themes tab which does export the current visualization as presented in the GUI in one of the available formats (Image, ASCII, or KML). It is only available with a valid field strength calculation and visualization. Some formats (ASCII) are limited to Professional licensees.



Export requires a previous selected visualization Theme and is restricted to the presented result. Please select the required theme accordingly before running the export.



10.14.1 How to Export a Theme

1. Start a field strength area calculation and select a visualization theme.

How to run a field strength calculation is described in 10.2. Available visualization themes and its selection are discussed in 10.6ff.

2. Choose **Themes**→**Elevation**→**Export**.

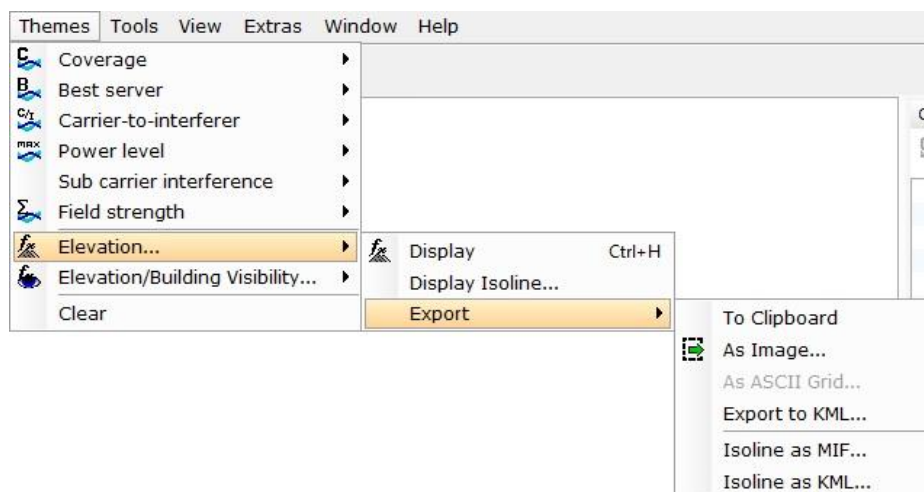


Figure 365: Select Export sub-menu

3. Choose the export format.

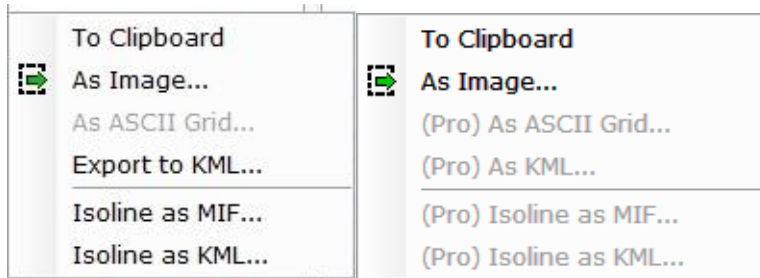


Figure 366: Available export (themes) formats (left: Professional-Edition | right: Community-Edition)

- **To Clipboard:**

The actual map will be copied in the system buffer like a screenshot and can be woked by **Paint**, for example.

- **As Image:**

The actual map will be saved in a .png or .jpg file.

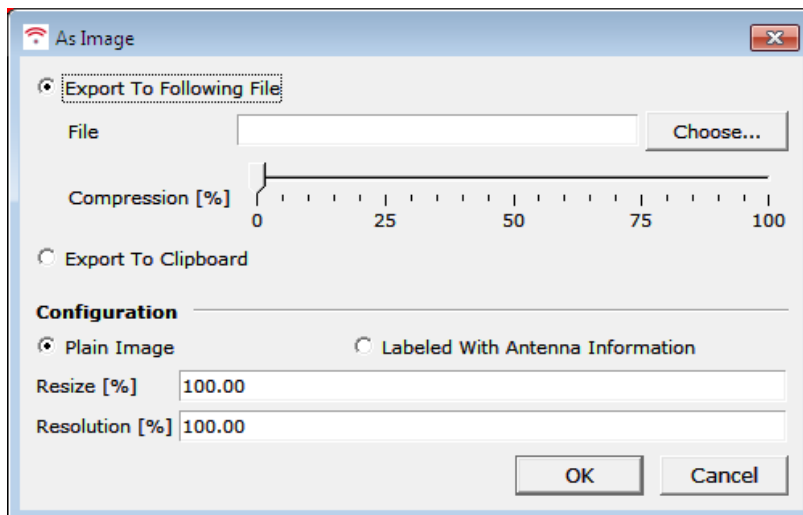


Figure 367: Export settings by export as image

- **As ASCII Grid:**

Export to ASCII requires a Professional license. It exports in an ASCII grid format which can be imported by almost any GIS software.

- **As KML:**

The actual map will be saved in a .kml file. This file can be used in other programs like Google Earth.

10.15 Clear Calculation and Theme Cache

Clearing the calculation and theme cache is a fundamental thing that has to be done regularly to keep an overview on the project. There are a few possibilities to clear the calculation and theme cache or even to disable calculations or themes from time to time. An

important fact to keep in mind is, WiMAP-4G operates on different layers which can be activated or deactivated as desired.

Clearing the calculation and theme cache works for the following calculations:

- **coverage theme**
- **best server theme**
- **carrier to interferer theme**
- **power level theme**
- **Sub Carrier Interference theme**
- **field strength theme**
- **theme isolines**
- **elevation isolines**



The clear cache feature does not work for the field strength area calculation.



10.15.1 How to Clear the Calculation and Theme Layer

1. Choose **Themes**→**Clear**.

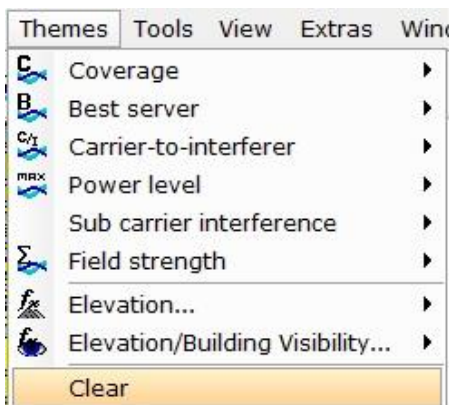


Figure 368: Clear the calculation layer



This will delete the whole calculation or theme from the project. Keep in mind that the calculations or themes cannot be returned and that this operation cannot be reverted. Time consuming calculations may have to be made again.



The more elegant way to hide themes is to deactivate the corresponding layers in the layer tab. For more information about layers, layer activation and deactivation, see chapter 2.5.2.

11 Isolines

Isolines connect points of equal value on the map. The prefix iso means equal. Isolines can be used for presentation and to keep overview on a project. They can be exported and imported to other programs, for example, Google Earth.

There are two different types of isolines in WiMAP-4G:

- **theme isolines**
- **elevation isolines**

11.1 Theme Isolines

Theme isolines are used to show the coverage of an area. They are geared to the coverage theme or the field strength area calculation. Therefore it is necessary to make a field strength area calculation before creating theme isolines.



11.1.1 How to Create Theme Isolines

1. *Make a field strength area calculation and create a theme.*

(A more precise calculation offers better overview but takes more time to calculate.)



To make a field strength area calculation see chapter 10.2.1.

2. Choose **Themes** → **kind of themes** → **Display Isoline...**

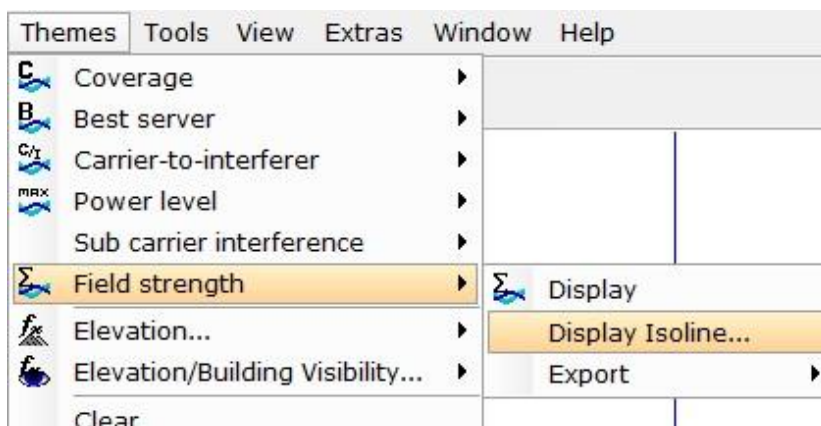


Figure 369: Create isolines

3. The theme isolines window opens and some configuration will be needed.

Just check the states which should be marked with isolines, change the color and press **OK** to start the calculation. Checking **Remove existing isolines** deletes former isolines from the project while calculating new isolines.

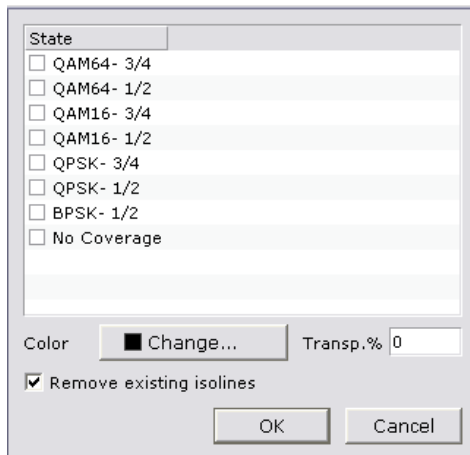


Figure 370: Choose the states for the isolines

It should be clear that all checked states will be included in the mark on the map. So if all states are activated, only a square will be marked because all the states are included. It is recommended to make isolines for the desired states separately and in different colors for a better overview. In our example, the colors have been taken from the coverage color profile.

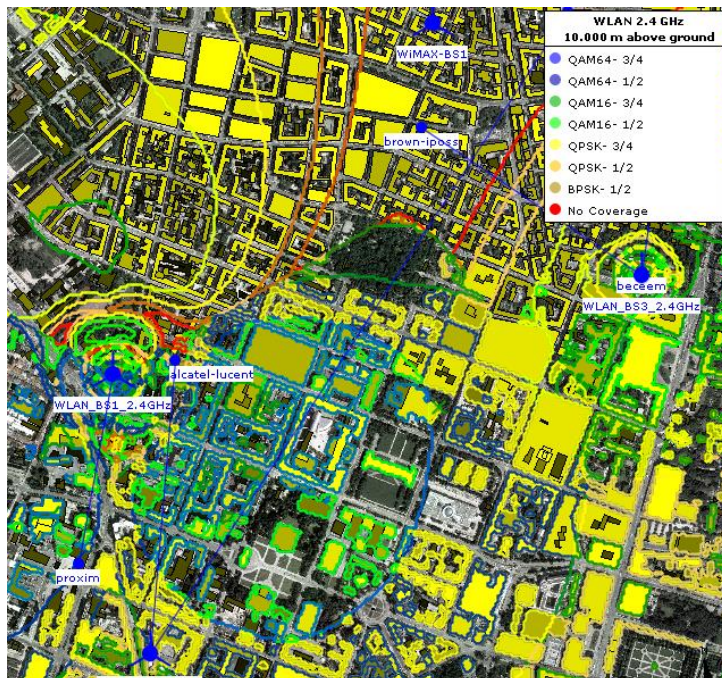


Figure 371: Theme isolines example, Munich, coverage

Buildings make the isoline calculation more detailed but the overview can get lost fast, because there are so many labels around buildings. Keep in mind that the elevation labels can be deactivated in the layers tab of the Project-Explorer.

11.2 Elevation Isolines

The elevation isolines can be used to mark different heights in the environment. They can be exported and guide themselves on the elevation model. An elevation model is required to create elevation isolines.



11.2.1 How to Create Elevation Isolines

1. *Import an elevation model.*



To import an elevation model, see chapter 4.2.1.

2. *Create an elevation theme.*



To make an elevation calculation, see chapter 10.12.1.

3. Choose **Themes→Elevation→Display Isoline....**

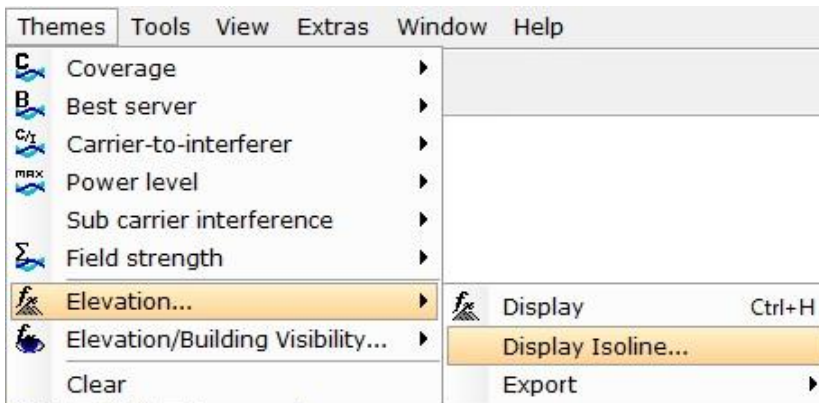


Figure 372: Create elevation isolines

4. The elevation isolines window opens and some adjustments have to be done.

Resolution [m] 10.000

Step Size [m] 10.000

Color  Change... Transp.% 0

☒ Remove existing isolines

OK Cancel

Figure 373: Fill in the desired values

Choose the **resolution** (a more precise resolution takes more time to calculate but offers better results) and the **color** and **transparency** for the isolines.

The step size describes the difference between two isolines on the same environment in m. If there is a height difference of 8 m all around the environment, only one isoline will be shown while using the default 10 m. With a step size of 2 m, four different isolines will pop up for the same environment, each of them for a different height level.

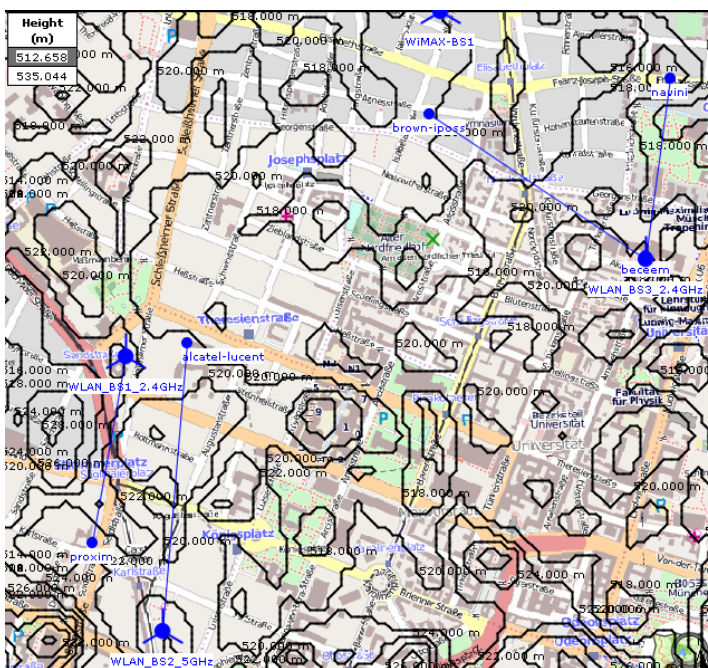


Figure 374: Elevation isolines example, Munich

11.3 Isoline Export

Sometimes it could be necessary to export for theme or elevation created isolines.

Exporting isolines is possible with WiMAP-4G. It is especially helpful for importing these isolines to other projects, for example, to show them in presentations joining programs that work with isolines, like Google Earth.

11.3.1 How to Export Isolines as MIF



Assuming that isolines have been created. Otherwise the export may be possible but it would not offer any usable data.

1. Choose **Themes**→***kind of theme***→**Export**→**Isoline as MIF**.

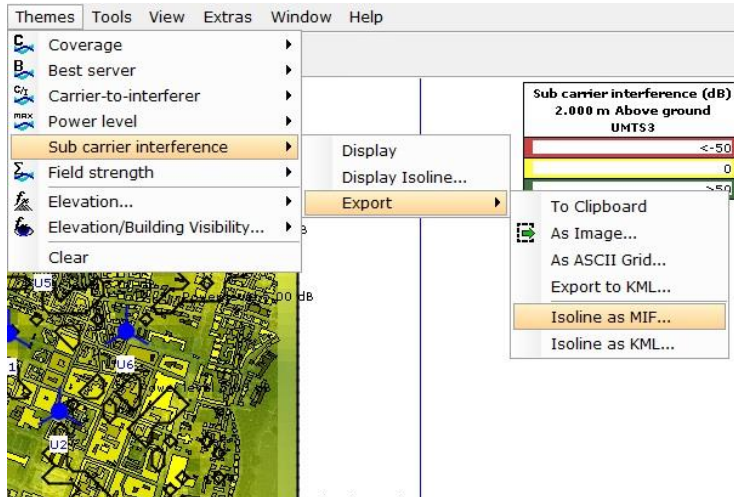


Figure 375: Export isolines as .mif file

2. Choose a **filepath** and a **filename** and press **OK** to save the file.

There are not any settings that can be done. All displayed isolines will be exported. All theme isolines will be exported to the .mif format and can be used in other programs that can handle the .mif format.



11.3.2 How to Export Isolines as KML

Assuming that isolines have been created. Otherwise the export may be possible but it would not offer any usable data.

1. Choose **Themes**→***kind of theme***→**Export**→**Isoline as MIF**

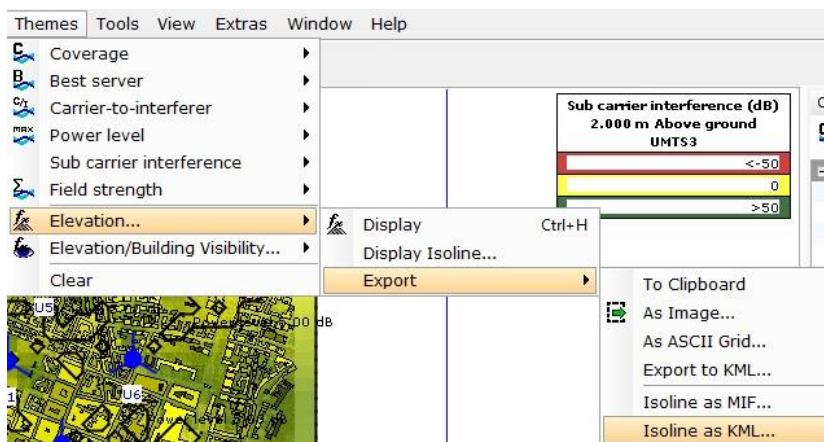


Figure 376: Export isolines as .kml

2. Choose a *filepath*, *filename* and press *OK* to save the file.

There is no need to do any settings. All displayed isolines will be exported. All theme isolines will be exported to the .kml format and can be used in other programs that support the .kml format.



Unlike the .mif format, the .kml format can be used with many programs. The most common is Google Earth, which can import and display .kml isolines.

12 3D-View

With the 3-dimensional view, impressing presentations can be done for various projects. A 3D environment will be rendered for the actual project, showing all objects that have been placed and all calculations that have been done in the project. This is useful to get a good overview about how everything might look in reality. It is also possible to determine potential problems with the 3D-view.



12.1 How to Create a 3D-View

1. Choose *View→Create 3D View*.

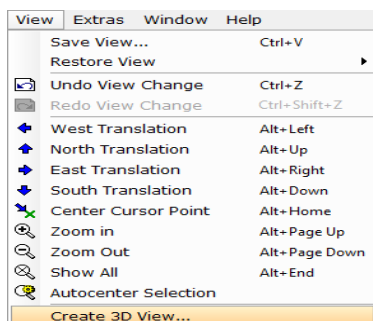


Figure 377: Create a 3D-view

The 3D-view window opens and the actual project will be shown in 3D. Every calculation can be shown in a 3D model, so feel free to make a few calculations before creating a 3D-view. This will give a much better view, also problems can be determined much better with the corresponding calculation, shown in the 3D-view.

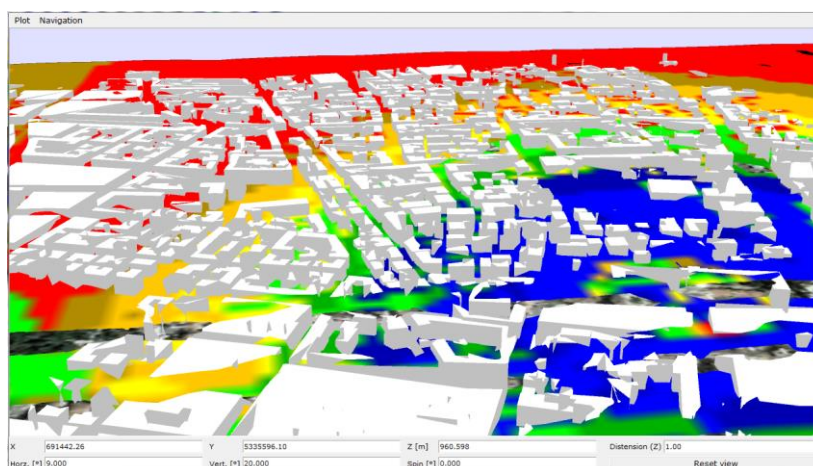


Figure 378: Example 3D-view

As shown in the Figure 378, all buildings are created in the 3D-view. A coverage calculation with the typical parameters and colors is shown here.

12.2 Navigate the 3D-View

Navigation inside the 3D-view is quite simple. Holding down the right mouse button enables the "look" function. Simply slide the mouse to change the camera view. Holding down the left mouse button enables the "move" function. Slide the mouse to move around the map. With these two functions, nearly every move can be done on the map. The attentive user may have also discovered the labels at the bottom of the window. These seven labels allow to view everything on the map from every angle and distance.

The **X** and **Y** labels describe the actual coordinates of the camera.

The **horizontal** and **vertical** describes the angle of the camera. Experimenting a little with these values make it quite clear how to use them.

The **Z**, **spin** and **distension** are interesting labels. They can make it much easier to locate and show specific objects. This will only happen if the user knows how to use them. Keep in mind that they can also cause the whole view to vanish from the screen if useless values were inserted.

X	689337.77	Y	5334260.62	Z [m]	960.598	Distension (Z)	1.00
Horz. [°]	45.000	Vert. [°]	22.500	Spin [°]	0.000	Reset view	

Figure 379: The labels

The **distension** is the axial extension of the Z-axis. Therefore a higher value stretches the buildings and make them higher for the human eye. This is useful if the project only holds buildings with small heights. The distension will stretch them a little bit and gives them better visibility. The maximum value of distension is 10, which means a building will be shown 10 times higher than in reality.

The **spin** just spins the view a little bit to the desired angle. Playing with that value shows effects quite clear.

The **Z** label is the most interesting because it allows the user to zoom in and out. A function, which could sometimes be required to show specific objects or discover problems, that may be hid in detail.

The first thing to understand is that a 3D-view cannot exist with only an X- and Y-axis. A third axis is required to add a steric component. This required axis is the Z-axis. Playing a little bit with this value should show the effect.

Keep in mind that a value smaller than the average area height used in the project will make the project disappear in the 3D-view.

Always use a value higher than the highest point in your project.

An elevation calculation may help to determine the height of that highest point.

12.2.1 Navigation Specials

Integrated in the 3D-view window, there is a menu named **Navigation** which offers a few possibilities to navigate through the 3-dimensional environment:

- **Camera Platform:** The standard view which allows the user to navigate with the mouse buttons and the labels at the bottom of the window.
- **Autopilot:** Starts a camera flight over the environment and is a good application for presentations.

Center Antenna: Opening the 3D-view is sometimes quite confusing. Antennas cannot be found really fast because they are hidden between the buildings. A field strength area calculation maybe helps to locate the antennas a little bit better, but it is not the optimal solutions for presentations. The Center Antennas Option opens a window, showing all the antennas used in the current project. Now a specific antenna can be selected and the view will change to the antenna residence.

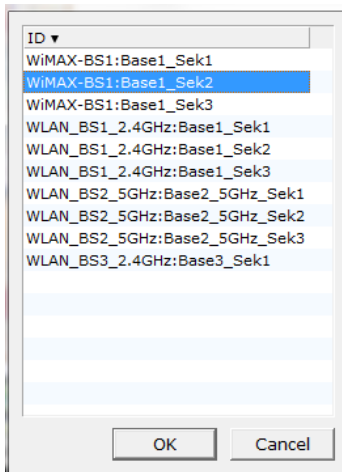


Figure 380: Choose the desired antenna

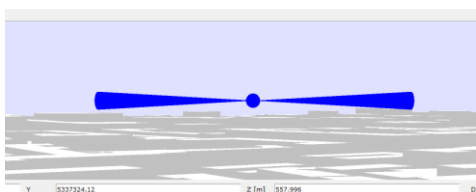


Figure 381: The antenna will be focused

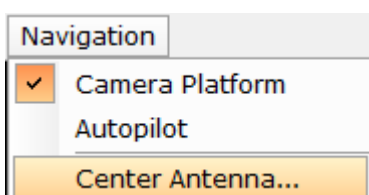


Figure 382: Navigation specials, choose Center Antenna

12.3 Export a 3D-View

A 3D-view can also be exported.



12.3.1 How to Export a 3D-View

Assuming that a 3D-view has been created. The export of a 3D-view is only possible from within the 3D-view window.

1. Choose **Plot→Export**.

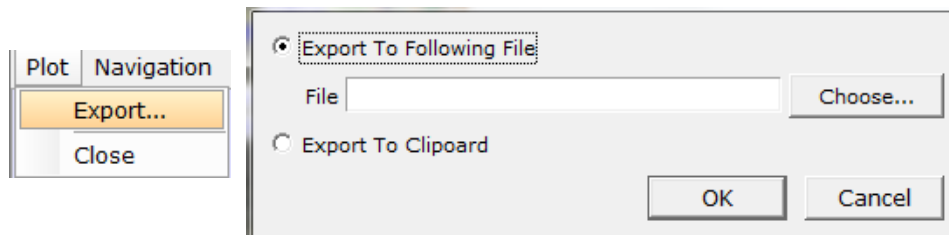


Figure 383: Export 3D-View

2. Decide to export the picture directly to a file or to the clipboard.

The clipboard option allows the user to paste the picture in another program, for example, Microsoft Word. If you want to export the picture directly to a file, choose a filepath by entering the path or click on **Choose** to navigate through the computer.

Click on **OK** to export the picture.

A .png file is saved at the specific filepath now and can be opened with every program that supports the .png format.

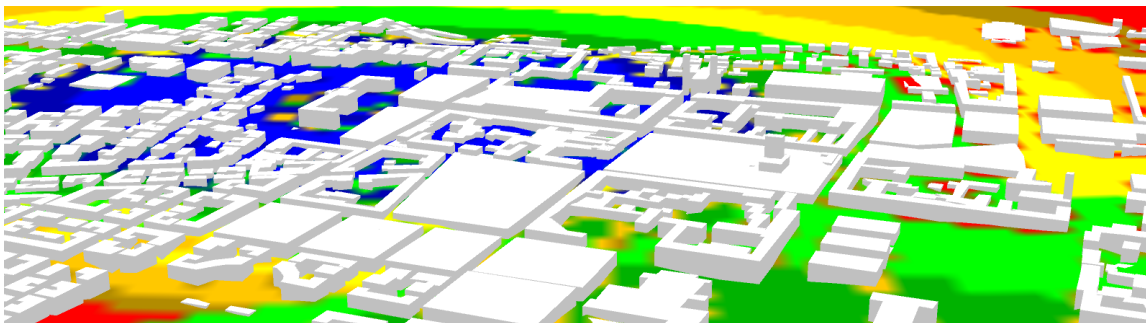


Figure 384: Exported .png

13 Glossary

Community-Edition: The Community-Edition is the free version of WiMAP-4G. It offers all the important features but with certain limitations, for example, only 12 antennas in the same project. The Community-Edition was released to give potential customers a good overview on the flexibility of WiMAP-4G.

Professional-Edition: The Professional-Edition is the purchased version of WiMAP-4G. It offers all features of the Community-Edition plus additional features, for example, more antenna pattern. There are no limitations in the Professional-Edition which make it the perfect tool to plan even the largest projects.

License: A license is required for the Professional-Edition. It can be ordered at the WiMAP-4G product support. Latest pricing information are available at www.wimap-4g.com. Contact info@brown-iposs.eu for more information and for ordering a license.

Terrain-Profiler: The Terrain-Profiler is a useful tool to get an overview on the environment and the elevation on the project. It can be used in several ways. The main aspect of the Terrain-Profiler is the ability to detect problems in the terrain while link two sites. The Terrain-Profiler is a drag and drop tool which detects buildings, mountains or even trees that could interfere the connection. It is also possible to start a link budget calculation with the Terrain-Profiler. Results can be plotted or exported for presentations.

Geodata: Geodata is computerized geographical information which can help the user to get a better overview of the environment and the buildings in the project area. There are many types of geodata available on the internet. Special data like elevation models or cadastral data can be imported and used in WiMAP-4G projects. These data sometimes need to be purchased due to the high expense of creating them. Therefore they are very precise and qualified to be used in WiMAP-4G to achieve better results.

Project: A project includes a network which consists of all locations with their systems (for example WLAN, WiMAX...), antennas and the included data (for example geodata, background image...). A project also includes all settings done within it (for example propagation settings or graphical settings).

Cadastral Data: Cadastral Data is vectored graphical information which typically consists of many layers. Cadastral data is used to get an overview on the environment and especially on buildings and boundaries of landownership in the project. WiMAP-4G supports the .dxf format. Cadastral data can be purchased from the local land survey register.

Elevation Model: Elevation models describe the topography of the ground surface. The elevation model is represented as a raster with a fixed cell size. The cell size characterizes the quality of the elevation model. A smaller cell size results in a higher precision. The elevation model is a very critical part of the project because imprecise data can cause problems, not during planning but in reality. Always try to find a highly precise elevation model to get the best results possible. The Terrain-Profiler cannot work properly without an elevation model.

Background Image: Background images can be imported in WiMAP-4G. They can hold all desired information, for example, satellite photography of the calculated terrain. The orientation will become much better with a background image showing the actual surface, buildings, wood etc. WiMAP-4G supports .tif, .tiff, .jpg and .png format for a background image import.

Network: A network contains all the locations and sites with their corresponding antennas.

Site: A site is a base station holding active antennas. This can include many different systems, carrier and antennas.

Point: Among the sites, WiMAP-4G supports another essential data type, the points. Points can be used to get an overview on special places like potential customer locations or other site locations for the future. There are calculations for these points to check, for instance, the field strength on a special place or area.

Point Categories: To create different types of points, WiMAP-4G offers the possibility to create point categories. This helps the user to differentiate the points.

Antennas: WiMAP-4G supports every kind of antenna (for example omni, yagi). Antennas will be considered with the help of antenna diagrams. These diagrams contain a detailed description of the vertical and horizontal attenuation which will be provided by the manufacturer in most cases. Antenna information can be imported in several ways (Planet-format) like .dat, .adf, .msi. Each antenna needs to be assigned to exactly one antenna type.

System: In most cases, a network consists of different system-techniques, in short "systems". Especially for last mile connections, many different types of hardware and frequencies are in use (for example WLAN based on the 802.11a standard) compared to the connections between the sites (they will be connected for example with a radio relay system based on the 802.16a standard).

Field Strength: The field strength is the quantitative expression of an electric field on a specific point. The unit is volt per meter (V/m). The strength of the electric field depends on many factors especially the transmission power, the distance between station and receiver and inferences between those. With these parameters, the field strength can also differ on the same location, probably influenced by weather effects or vegetation. To prevent malfunction, WiMAP-4G always calculates the average achieved field strength. All themes are

based on a field strength calculation which need to be made before calculating, for example, the power level or carrier to interferer.

Field Strength Area Calculation: WiMAP-4G offers two different kinds of field strength calculations. The field strength area calculation shows the field strength prognostic for every pixel in a huge area. However the point field strength calculation offers a field strength prognostic for specific denoted points (for example potential customer locations).

Site to Site: Connecting two sites requires a fixed network connection or a dedicated wireless interface. Sites which are directly connected to the core network are named master sites. Sites that are not directly connected to the core network are called clients. For clients it is important to come down with a good radio link (most if the time with beam radio), to redirect all incoming traffic to a master site. The master site finally transfers all incoming data to the core network. Connections between sites are called site-to-site connection. WiMAP-4G offers the possibility to make a site-to-site calculation to determine the path loss between two sites. This can be useful to decide whether two sites can cooperate in a specific area or not.

Themes: WiMAP-4G offers a lot of possibilities to visualize or display georeferenced results of field strength calculations and the resulting conclusions (for example coverage, power level...).

Coverage: Based on the field strength calculation results that can be achieved by clicking Calculation→Field Strength Area Calculation, the coverage can be displayed.

Best Server: With the help of the best server calculation, it can be determined which site (best server) offers the best signal for a specific area.

Power Level: To rate the coverage on a specific point, it is necessary to determine the power level on that area. The power level calculates the power received from a normal receiver for the observed system at the radio frequency input in dBm.

Calculation Layer: After a field strength calculation has been done, the results are conditioned and can be presented in different ways. These results will be constantly available, even in case of changing some network parameters. It is also possible to make different field strength calculations for different network parameters. The results can be activated at the calculation layer at any time. To obtain a good overview, calculations are always temporary and will be deleted after making a new calculation of the same type. To keep a calculation available at any time, it can be saved in the calculation tab of the project explorer.

3D-view: It is possible to create a 3D-view of the current project in WiMAP-4G. A better observation is possible with the help of the 3D-view. Calculation results also will be shown in the 3D-view.

Graphic: Graphics in WiMAP-4G include all details associated with georeferenced display of background data, network and calculation results. These are displayed in the Project- and Terrain-Explorer and can be printed and plotted.

Log: While making calculations with WiMAP-4G, many different things are done in background, invisible for the average user. The background actions will be protocolled and shown in the log. If an error occurs, or a calculation does not seem to offer proper results, the log maybe throw out some exceptions or warnings. With the help of these exceptions or warnings, it is sometimes possible for the user to fix the problems.

Layer: WiMAP-4G works with layers. That means, that every information, calculation, structure is drawn or calculated in its own layer, which can also be activated or deactivated for a better overview. The Project-Explorer holds a tab called the layer tab. This layer tab lists all the layers, used in the current project and every layer can be checker or unchecked. Every action or import adds a separate layer.

Building Classes: For a better overview, WiMAP-4G offers the possibility to arrange buildings in building classes. This is also necessary to create advanced buildings with towers or courtyards. Building classes can be differentiated by colors.

Corine: The Corine Land Cover is referring to an European program establishing a computerized inventory on land cover of the 27 EC member states and other European countries, at an original scale of 1:100.000, using 44 classes of the 3-level Corine nomenclature. It is produced by the European Environment Agency and its member countries and is based on the results of IMAGE2000, a satellite imaging program undertaken jointly by the Joint Research Centre of the European Commission and the EEA. Corine data can be downloaded from the EEA-Website.

Carrier: In telecommunications, a carrier wave, or carrier is a waveform that is modulated with an input signal for the purpose of conveying information. This carrier wave is usually of much higher frequency than the input signal. The purpose of the carrier is usually either to transmit the information through space as an electromagnetic wave or to allow several carriers at different frequencies to share a common physical transmission medium by frequency division multiplexing.

Client: A client is usually used to refer to a current or potential buyer or user of the connection.

C/I: The carrier-to-interference ratio (C/I, CIR), is the quotient between the average received modulated carrier power S or C and the average received co-channel interference power I , i.e. cross-talk, from other transmitters than the useful signal.

Isolines: An isoline is drawn around an area that contains the same value of a parameter. WiMAP-4G supports isolines for all calculation that have a graphical output. Isolines can also be exported and imported in other programs that supports the .mif or .kml format.

14 FAQ

14.1.1 What is WiMAP-4G?

WiMAP-4G is the radio network planning tool by brown-iposs. It offers a simplified, engaging way to plan, investigate, manage and analyze wireless networks.

14.1.2 Does WiMAP-4G support 64-bit operating systems?

Yes, on Windows 64-bit OS versions. To start the 64-bit version please select "wimap-4g-64bit.exe" instead of "wimap-4g.exe" and assure that you are working with a 64-bit Java Runtime Environment.

14.1.3 Which languages does WiMAP-4G support?

In the current version, WiMAP-4G supports English language only. Other language can be supported on request.

14.1.4 Do I have to be online to use WiMAP-4G?

No, but: You need to be online to get a license for your WiMAP-4G installation. An internet connection is also necessary if you want to use OpenStreetMap to plan your maps. Additional satellite photos and elevation models can be down-loaded from within the program if an internet connection is available.

14.1.5 What file formats does WiMAP-4G support?

File format	Use
.rap	project import/export, save/load projects
.dxf	cadastral data import
.asc, .asg	elevation data import
.gif, .tif, .tiff, .png	background image export/import plot, Terrain-Profiler diagram export 3D-view export
.mif	import/export buildings/structures export isolines
.shp	Corine data import
.csv	antennas/points import/export
.kml	plot export
.zip	calculation import/export
.msi, .dat, .adf	antenna pattern import/export

Table 2: File formats supported by WiMAP-4G

14.1.6 How much does WiMAP-4G cost?

The costs of WiMAP-4G depends on the used edition, number of licenses and selected propagation models that shall be planned with WiMAP-4G. Since there is no constant price for all these features, a detailed price list can be obtained from the WiMAP-4G website.

14.1.7 What is the difference between WiMAP-4G Editions?

The Professional-Edition offers the complete feature set, apart from services that need to be licensed against third parties. The Community-Edition has additional project orientated limitations. The number of sites in the same project is limited. Also the resolution for displaying the calculation results is limited and part of the import/export functions are inaccessible. We reserve us the right to restrict new and more functionalities in future releases of WiMAP-4G Community-Edition.

14.1.8 What are the requirements to get a license?

Activation is necessary for the Professional-Edition as well as for the Community-Edition. After purchasing the WiMAP-4G Professional-Edition, a USB-dongle carrying the license is delivered to you for the activation of your Professional-Edition. The Community-Edition also needs activation, but the only requirement is a valid e-mail address, license file is sent by e-mail.

14.1.9 Can I upgrade my Community-Edition to Professional-Edition at a later time within the program?

Yes, it is possible to use the Community-Edition and make an upgrade at any time later. It is sufficient just to plug-in the USB-dongle (having the Code-meter runtime environment installed) into your computer and start WiMAP-4G.

14.1.10 Do I have to update my WiMAP-4G from time to time?

WiMAP-4G will automatically search for updates from time to time. If a new update has been found, WiMAP-4G will ask you to download and install the update.

15 Troubleshooting

P: I cannot install WiMAP-4G: You do not have the required permission to run this file.

S: Administrative permission is needed to install WiMAP-4G. Please contact your system administrator for further information.

P: WiMAP-4G does not start.

S1: Check out if you have the right permission to run this program. Contact your system administrator for further instructions.

S2: Installation may be broken, try to reinstall WiMAP-4G.

P: I cannot activate my Professional-Edition: Your license file is damaged.

S: Your license file is not valid. Activation by license file (like done for Community edition) is no longer supported. Please contact info@brown-iposs.eu for a new license file.

P: Corine does not show any data.

S1: The Corine data is corrupted. Please contact the EEA for a solution.

S2: The Corine data does not contain any information for the actual content (the blue frame). Make sure that the downloaded Corine data is valid for your project.

P: Calculation takes very long time.

S1: If the workstation is an older one, calculation can take some time due to the hardware that is used. Try a faster system to get a faster calculation.

S2: Try another quality for the calculation. A higher precision takes a lot more time to calculate. Make sure that the used precision level is in need for your requirements.

P: New preconfigured Project: I cannot find the desired place via specified address.

S1: Try other keywords for your desired place.

S2: Try also zip codes.

S3: Take another place near the desired one and choose a bigger frame for the project.

P: Not enough memory for calculation.

S1: This usually happens while making calculation with very high quality on a low memory machine. Making a detailed calculation using the CORLA Raylauncher can consume far more than 4 Gigabyte of RAM.

S2: The used memory can be set to a specific maximum value in the



wimap-4g.vmoptions

Open the file using the windows editor and change the maximum Java heap size.

P: OpenStreetMap: Tile X/Y/Z could not be loaded.

S: OpenStreetMap is not reachable at the moment. Check your internet connection or try it again later. This can also indicate a problem with your firewall. Contact your system administrator for further information or support.

P: I cannot use CORLA Raylauncher.

S: Since the CORLA Raylauncher is not a brown-iposs application, it is a third party software and needs a license to work for every special scenario. If you need a license, contact info@brown-iposs.eu for further information.

P: Cadastral data does not show up after import.

S1: Make sure the cadastral data layers are activated. Check the layer tab in the Project-Explorer.

S2: Cadastral data needs specific coordinated while import. If you have not specified any coordinates for the cadastral data position, it can be found at the coordinates 0,0.

P: Building intersects buildings of the same type

S: This usually happens if you want to construct buildings inside other buildings using the same building class. Create a new building class and use that new one while construct the new building inside the old one.

P: Points does not show up in the points tab.

S: Make sure, the right point-category has been chosen on top of the point tab in the Project-Explorer.

P: Antenna Pattern: An I/O error occurred due to following reason: Pattern "....." could not be read.

S: The antenna pattern is corrupted. Depending on the source off the file, contact the manufacturer of the antenna for a new pattern. You can also try to repair the corrupted file.

Detailed instructions in how an antenna patten should look like can be found in chapter 7.1.2.1.

P: Load Project: org.xml.sax.SAXParseException: Premature end of file.

S: The project file is damaged.

P: Load Cadastral: An I/O error occurred due to following reason: Error encountered in line -x: Unexpected EOF encountered in line -x.

S: The cadastral data file is damaged. Depending on the source, get a new fresh file and try it again.

P: Load Corine: An I/O error occurred due to following reason: Premature end of header.

S: The Corine file is damaged. Depending on the source, get a new fresh file and try it again.

P: Specified Address: An I/O Error occurred due to following reason: gazetteer.openstreetmap.org

S: Check your internet connection. Connection to OpenStreetMap cannot be established. If your internet connection is working, the OpenStreetMap server is down at the moment. Try again later.

P: An internal error has been detected.

S: WiMAP-4G always saves a copy of the error in the folder WiMAP-4G/Profile. Feel free to send this error report to info@brown-iposs.eu.

P: I cannot choose a calculation from the menu.

S: A field strength area calculation need to be done to enable other calculations. Choose **Calculation->Field Strength Area Calculation**.

P: The Elevation Model does not load, by a created project: An I/O Error occurred due to following reason: [Data Path] (The system cannot find the data path).

S: Delete the folder of the data path. If the path cannot found, token in folder- and search option the option display hidden folder. After delete, the project could be imported again.

P: I cannot select antennas and carriers (lists are empty)

S: Delete the default.rad data in C:\Users\“UserName”\AppData\Roaming\bips\WiMAP-4G. If the path cannot found, take in folder- and search option the option display hidden folder.

P: Starting calculation: An internal error has been detected!

S: Check whether all site inside the blue area (Elevation Model).

16 Image directory

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